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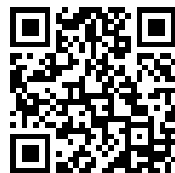
1916

THE AMERICAN SOCIETY *of*

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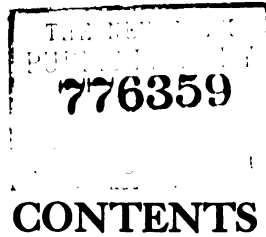
Engineering Data from recent publications of the Society are included

SIXTH ANNUAL VOLUME

OCTOBER, 1916

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PREFACE

CATALOGUE SECTION

	PAGE
Index to Firms Represented.....	5, 6, 7, 8
 PART I, Power Plant Equipment.....	 9
 PART II, Power Transmission Machinery, Elevating and Convey- ing Machinery, Hoisting and Transporting Machinery.....	 135
 PART III, Raw Materials, Metals and Alloys.....	 197
 PART IV, Metal Working Machinery, Machine Tools and Acces- sories, Shop Equipment.....	 211
 PART V, Compressors, Fans, Blowers, Pumping and Hydraulic Machinery, Drying and Crushing Machinery, Engineering Miscellany.....	 271
 PART VI, Measuring and Recording Apparatus.....	 311
 DATA SECTION	
Mechanical Engineering Data.....	343
 DIRECTORY SECTION	
Mechanical Equipment Directory.....	385

PREFACE

IT is with special pleasure and a certain sense of achievement that the Society presents to the membership, and to the mechanical engineering profession at large, the Sixth Annual (1916) Volume of *A. S. M. E. Condensed Catalogues of Mechanical Equipment*.

To any careful observer it must be apparent that as our great industrial expansion goes on, the problems involved in establishing and maintaining closer and more efficient buying relations between the manufacturer and the user of engineering equipment are becoming more and more complicated.

Processes of manufacture are constantly growing more intricate, and equipment more diverse, which naturally leads to a great multiplication and elaboration of manufacturers' catalogues, booklets and other sales literature. For many years past the executive concerned in the selection and specification of material has found the indexing and handling of these individual catalogues an increasingly burdensome task; and this condition has inevitably brought about the publication of a number of combined catalogue systems issued for the benefit of various fields of manufacture.

To assist in the solution of these problems would seem to be one of the most valuable forms of service which an organization like this Society can render to the particular branch of engineering it aims to serve, and six years ago a beginning was made in the publication of the first edition of the Condensed Catalogues. The reception accorded to this initial volume was so favorable that there could be no room for doubt as to the great value of the service to the membership, and to the mechanical engineering field in general.

During the intervening period a progressive study has been made of the whole subject of informative and standardized publicity along mechanical engineering lines; and this has led to constant improvements and enlargements in the successive volumes of the Condensed Catalogues, culminating in the present edition, which represents an entirely new departure among publications of this class.

Leaving aside the periodicals carrying display advertising, there remain two distinct groups of publications available for purposes of engineering publicity. 1. Directories carrying display matter interspersed throughout the listing material. 2. Combined or coöperative catalogues, containing condensed and uniformly arranged catalogue data of manufacturers, to which class the volume of Condensed Catalogues belongs.

Prior to 1915 all publications in this second group, including our own, had held strictly to the policy of indexing only those firms using and paying for space. While this policy is in many respects

PREFACE

logical, it has nevertheless tended to restrict the value of such compilations as works of reference, for the reason that through one cause or another many prominent firms would be without representation in any given edition.

In last year's volume of the Condensed Catalogues an experiment was made, consisting in offering to manufacturers the opportunity of securing listings in the Classified Directory of the volume at small cost, and independently of the use of space. This experiment proved highly successful, resulting in the enlargement of the Classified Directory to twice its previous size, with a corresponding increase in the scope and value of the volume as a work of reference.

After further careful study and analysis of the situation, and as the result of numerous suggestions received from our members and others, it was decided to carry the development to its logical conclusion in the 1916 volume by listing in the Classified Directory, free of charge within reasonable limits, the names and addresses of all the manufacturers in the field that were accessible through the records of the Society and through the connections of the membership.

This plan was accordingly carried out, and the current volume is presented in a form which may fairly be considered as representative of the manufacturing facilities of the entire mechanical engineering field. The Catalogue Section contains informative data of the greatest reference value concerning the products of 267 firms; while the new and comprehensive Classified Directory Section (see colored pages) lists the products of over 2500 manufacturers, classified under more than 2000 different subject headings. The Engineering Data Section, which was one of the new features in last year's volume, is also continued in extended form in this edition.

While the rates for publication of catalogue data have remained unchanged at seventy dollars for one page and fifty dollars for each additional page, the considerable extra cost of compiling and publishing the enlarged Classified Directory has been offset by the increase in the amount of space used by manufacturers in the Catalogue Section of the volume. The Society takes this opportunity to express its thanks to these firms, who, by their coöperation, have made possible this latest and most important development in the service rendered by the Condensed Catalogues.



NOTE : All data presented has been edited with a view to the elimination of advertising claims or exaggerated statements and every effort made to restrict the Condensed Catalogues to firms of good standing only. Publication of catalogue data does not constitute in any sense an endorsement by the Society of the firms or products thus represented.

Extract from Constitution : C55. The Society shall not be responsible for statements or opinions advanced in papers or in discussions.

INDEX TO CONDENSED CATALOGUES

A

	PAGE
Acme Machine Tool Co., Cincinnati, O.	218
Aero Pulverizer Co., 120 Broadway, New York, N. Y.	68
Albany Lubricating Co., 708-710 Washington St., New York, N. Y.	123
Allan & Son, A., 494 Greenwich St., New York, N. Y.	200
Alliance Machine Co., Alliance, O.	188
Almy Water Tube Boiler Co., Providence, R. I.	33
Aluminum Co. of America, Pittsburgh, Pa.	205
American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y.	281
American Blower Co., Detroit, Mich.	280
American Brass Co., Waterbury, Conn.	204
American Bronze Co., Berwyn, Pa.	198
American District Steam Co., North Tonawanda, N. Y.	118
American Engine & Electric Co., Bound Brook, N. J.	10
American Injector Co., Detroit, Mich.	116
American Metal Hose Co., Waterbury, Conn.	132
American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.	142
American Screw Co., Providence, R. I.	256
American Steam Gauge & Valve Mfg. Co., Boston, Mass.	115
*American Vulcanized Fibre Co., Wilmington, Del.	203
Andrews, Inc., William, 120 Liberty St., New York, N. Y.	84
Anthony Co., 138 West Ave., Long Island City, N. Y.	264
Armstrong Cork & Insulation Co., 122 24th St., Pittsburgh, Pa.	120
*Ashton Valve Co., 271 Franklin St., Boston, Mass.	323
*Atlas Ball Co., Glenwood Ave. at 4th St., Philadelphia, Pa.	159
Atlas Press Co., 310 N. Park St., Kalamazoo, Mich.	217
Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y.	154

B

*Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.	34, 35, 36, 37
Badenhausen Co., 1429 Chestnut St., Philadelphia, Pa.	38
*Bailey Meter Co., 141 Milk St., Boston, Mass.	318
*Ball Engine Co., Erie, Pa.	11
Bass Foundry & Machine Co., Fort Wayne, Ind.	39
*Best, Inc., W. N., 116 Broadway, New York, N. Y.	265
Biddle, James G., 1211-13 Arch St., Philadelphia, Pa.	338
*Bigelow Co., 76 River St., New Haven, Conn.	40
Blake & Johnson Co., Waterbury, Conn.	235
Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y.	212
Boston Belting Co., 84 Linden Park St., Boston, Mass.	162
Bradley & Son, Inc., C. C., Syracuse, N. Y.	216
*Bristol Co., Waterbury, Conn.	327
*Brown Co., A. & F., 79 Barclay St., New York, N. Y.	136
Brown Instrument Co., Philadelphia, Pa.	328
Brown Portable Elevator Co., Chicago, Ill.	179
Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y.	314
Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O.	161
Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Mo.	20

C

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill.	174
Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y.	284
Canton Grate Co., 1708 Woodland Ave., Canton, O.	71
Carbondale Machine Co., Carbondale, Pa.	307
Carborundum Co., Niagara Falls, N. Y.	248
Carey Co., Philip, Cincinnati, O.	121
Casey-Hedges Co., Chattanooga, Tenn.	42, 43
*Central Foundry Co., 90 West St., New York, N. Y.	105
*Chain Belt Co., 734 Park St., Milwaukee, Wis.	176, 177
Champion Rivet Co., Cleveland, O.	255
Chatillon & Sons, John, 85-93 Cliff St., New York, N. Y.	315
Cincinnati Ball Crank Co., Cincinnati, O.	254
Cincinnati Planer Co., Oakley, Cincinnati, O.	228
*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn.	190
Conveying Weigher Co., 90 West St., New York, N. Y.	175
Cook Belting Co., H. N., San Francisco, Cal.	163
*Cordrey Machine Works, C. H., Fitchburg, Mass.	236
*Crane Co., 836 S. Michigan Ave., Chicago, Ill.	88, 89, 90, 91
*Crocker-Wheeler Co., Amperre, N. J.	32
Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass.	324

Advertisements of firms marked * appear in The Journal, A. S. M. E.

INDEX TO CONDENSED CATALOGUES

	PAGE
D	
D & W Fuse Co., Providence, R. I.	253
Darling Pump & Mfg. Co., Ltd., Williamsport, Pa.	92
Davidson Steel Co., Inc., 124 Maiden Lane, New York, N. Y.	206
D'Este Co., Julian, 26 Canal St., Boston, Mass.	108
*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y.	25
*Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo.	319
Deming Co., Salem, O.	285
Detroit Lubricator Co., Detroit, Mich.	125
Detroit Stoker Co., Detroit, Mich.	62
Devine Co., J. F., Buffalo, N. Y.	298,
Diamond Expansion Bolt Co., 90 West St., cor. Cedar, New York, N. Y.	262
*Diamond Power Specialty Co., Detroit, Mich.	73
Dill Machine Co., Inc., T. C., Philadelphia, Pa.	229
Dodge Sales & Engineering Co., Mishawaka, Ind.	74, 144, 145, 146,
*Doehler Die-Casting Co., Brooklyn, N. Y.	147
Dunham Co., C. A., Marshalltown, Ia.	263
Durant Mfg. Co., Milwaukee, Wis.	112, 113, 339

E	
*Edge Moor Iron Co., Edge Moor, Del.	41
Edwards Mfg. Co., 306-336 Eggleston Ave., Cincinnati, O.	269
Ehret Magnesia Mfg. Co., Valley Forge, Pa.	121
Eimer & Amend, 205-211 Third Ave., New York, N. Y.	335
Epping-Carpenter Pump Co., Pittsburgh, Pa.	286
*Erie City Iron Works, Erie, Pa.	12

F	
Falk Co., Milwaukee, Wis.	138, 139
*Falls Clutch & Machinery Co., Cuyahoga Falls, O.	143
*Fellows Gear Shaper Co., Springfield, Vt.	230
Fitchburg Steam Engine Co., Fitchburg, Mass.	13
Planner Water-Tube Boiler Co., Akron, O.	44
*Flexible Steel Lacing Co., 522 S. Clinton St., Chicago, Ill.	268
*Ford Chain Block & Mfg. Co., 139 W. Oxford St., Philadelphia, Pa.	195
Foster Engineering Co., Newark, N. J.	109
Franklin Mfg. Co., Franklin, Pa.	121
*Fulton Iron Works, St. Louis, Mo.	21

G	
Gardner Governor Co., Quincy, Ill.	274
*General Electric Co., Schenectady, N. Y.	30, 31
*Gilbert & Barker Mfg. Co., Springfield, Mass.	266
*Gilmer Co., L. H., Vincent St., Tacony, Philadelphia, Pa.	164
Glasgow Iron Co., Pottstown, Pa.	60
*Goodrich Co., B. F., Akron, O.	133, 165
Gooley & Edlund, Inc., Cortland, N. Y.	231
Graton & Knight Mfg. Co., Worcester, Mass.	166
*Green Engineering Co., East Chicago, Ind.	64, 65
Green Fuel Economizer Co., 90 West St., New York, N. Y.	58
*Greene, Tweed & Co., 109 Duane St., New York, N. Y.	126
Gurney Ball Bearing Co., Jamestown, N. Y.	155
*Gwilliam Co., 253 W. 58th St., New York, N. Y.	160
Gwynn Gas Burner & Engrg. Co., 713-714 Empire Bldg., Pittsburgh, Pa.	70

H	
Hardie-Tynes Mfg. Co., Birmingham, Ala.	14
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y.	207
Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn.	237
*Harris-Corliss Engine & Machine Co., Providence, R. I.	15
Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa.	76, 77
Hastings Pavement Co., 25 Broad St., New York, N. Y.	270
Hess-Bright Mfg. Co., Philadelphia, Pa.	156
*Hill Clutch Co., Cleveland, O.	148
Hoggson & Pettis Mfg. Co., New Haven, Conn.	250, 251, 252
*Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa.	93
Houston, Stanwood & Gamble Co., Cincinnati, O.	46, 47
*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y.	186, 187

I	
Industrial Works, Bay City, Mich.	189
*Ingersoll-Rand Co., 11 Broadway, New York, N. Y.	272, 273

J	
*Jenkins Bros., 80 White St., New York, N. Y.	96, 97
*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y.	119
*Jones & Lamson Machine Co., Springfield, Vt.	220, 221, 222, 223

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

INDEX TO CONDENSED CATALOGUES

K

PAGE

Kearney & Trecker Co., Milwaukee, Wis.	232
Keasbey & Mattison Co., Ambler, Pa.	121
*Keeler Co., E., Williamsport, Pa.	45
Kelly & Jones Co., Greensburg, Pa.	94, 95
Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y.	98
Kerr Turbine Co., Wellsville, N. Y.	29
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y.	110
Koven & Brother, L. O., Jersey City, N. J.	301

L

Ladd Co., George T., 1620 Farmers Bank Bldg., Pittsburgh, Pa.	48, 49
*Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill.	293
Lamson Co., 100 Boylston St., Boston, Mass.	184, 185
Landis Tool Co., Waynesboro, Pa.	243
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.	69
Leslie Co., Lyndhurst, N. J.	111
*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y.	191
*Link-Belt Co., Chicago, Ill.	178
Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa.	107, 325
Long & Allstatter Co., Hamilton, O.	213
Lukens Iron & Steel Co., Coatesville, Pa.	61
Lumen Bearing Co., Buffalo, N. Y.	201

M

McCord Mfg. Co., Detroit, Mich.	127
McCrosky Reamer Co., Meadville, Pa.	246, 247
McIntosh & Seymour Corp'n, Auburn, N. Y.	22
Madison-Kipp Lubricator Co., Madison, Wis.	128
Main Belting Co., Philadelphia, Pa.	167
Malleable Iron Fittings Co., Branford, Conn.	106
Manistee Iron Works Co., Manistee, Mich.	287
Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa.	306
Mechanical Rubber Co., Cleveland, O.	169
Mehl Machine, Tool & Die Co., Roselle, N. J.	238, 239
Mietz Machine Works, August, 123 Mott St., New York, N. Y.	27
Milton Mfg. Co., Milton, Pa.	258
Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis.	50
Modern Tool Co., Erie, Pa.	244
Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill.	51
Monongahela Tube Co., Pittsburgh, Pa.	59
*Moore & White Co., Philadelphia, Pa.	149
*Morris Co., I. P., Philadelphia, Pa.	296
*Morris Machine Works, Baldwinville, N. Y.	288, 289
*Murphy Iron Works, Detroit, Mich.	66, 67
Murray Iron Works Co., Burlington, Ia.	16

N

National Brake & Electric Co., Milwaukee, Wis.	278, 279
National Lead Co., 111 Broadway, New York, N. Y.	260, 261
*National Meter Co., 84-86 Chambers St., New York, N. Y.	28, 316
*National Pipe Bending Co., New Haven, Conn.	78, 79
National-Acme Mfg. Co., Cleveland, O.	226, 227
New Departure Mfg. Co., Bristol, Conn.	157
New England Butt Co., Providence, R. I.	304
New Jersey Foundry & Machine Co., 88 West St., New York, N. Y.	193
New London Ship & Engine Co., Groton, Conn.	23
N. Y. Revolving Portable Elevator Co., 343-351 Garfield Ave., Jersey City, N. J.	183
Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y.	173
Newman Clock Co., 178 Fulton St., New York, N. Y.	336
Niagara Machine & Tool Works, Buffalo, N. Y.	214
Noble & Westbrook Mfg. Co., Hartford, Conn.	241
Nordberg Mfg. Co., Milwaukee, Wis.	17
*Norma Co. of America, 1790 Broadway, New York, N. Y.	158
Norton Co., Worcester, Mass.	249
Norwalk Iron Works Co., So. Norwalk, Conn.	275
Nuttall Co., R. D., Pittsburgh, Pa.	137

O

Oil & Waste Saving Machine Co., 1509 Real Estate Trust Bldg., Philadelphia, Pa.	130
Olsen Testing Machine Co., Timius, 500 N. 12th St., Philadelphia, Pa.	312

P

Page Boiler Co., 815-819 Larrabee St., Chicago, Ill.	52
Penberthy Injector Co., Detroit, Mich.	117
Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa.	297
Philadelphia Tramrail Co., Front & Tusculum Sts., Philadelphia, Pa.	194
Phoenix Iron Works Co., Meadville, Pa.	53
*Pickering Governor Co., Portland, Conn.	131
Pittsburgh Machine Tool Co., Braddock, Pa.	219, 292
*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa.	102, 103

Advertisements of firms marked * appear in The Journal, A. S. M. E.

INDEX TO CONDENSED CATALOGUES

	PAGE
Platt Iron Works, Dayton, O.....	290
Pratt & Cady Co., Inc., Hartford, Conn.....	100, 101
*Precision Instrument Co., Detroit, Mich.....	320
R	
Reed-Prentice Co., Worcester, Mass.....	224
*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis.....	129
Riehlf Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa.....	313
*Roebli's Sons Co., John A., Trenton, N. J.....	172
Root Co., C. J., 150 Bridge St., Bristol, Conn.....	340
*Roots Co., P. H. & F. M., Connersville, Ind.....	282, 283
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.....	168
*Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa.....	152, 153
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.....	259
S	
*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa.....	75
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.....	329
*Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y.....	170
Selas Co., 521 W. 23rd St., New York, N. Y.....	267
*Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.....	192
Shultz Belting Co., St. Louis, Mo.....	171
Simmons Co., John, 110 Center St., New York, N. Y.....	104
Sipp Machine Co., Paterson, N. J.....	234
Skinner Engine Co., Erie, Pa.....	18
Sloan & Chace Mfg. Co., Ltd., 6th Ave., Cor N. 13th St., Newark, N. J.....	233
Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y.....	337
*Smith Co., H. B., Westfield, Mass.....	308, 309
Southwark Foundry & Machine Co., Philadelphia, Pa.....	24
*Spray Engineering Co., 93 Federal St., Boston, Mass.....	87
*Springfield Boiler & Mfg. Co., Springfield, Ill.....	54
Stephens Mfg. Co., Roe, Detroit, Mich.....	99
Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y.....	196
Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill.....	300
T	
Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y.....	330
*Taylor Instrument Cos., Rochester, N. Y.....	331
Taylor Steam Specialty Co., Battle Creek, Mich.....	114
*Texas Co., 17 Battery Pl., New York, N. Y.....	124
Textile Machine Works, Reading, Pa.....	305
Thomson Electric Welding Co., Lynn, Mass.....	242
Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa.....	332
Torrington Mfg. Co., Torrington, Conn.....	240
Turbo-Gear Co., Inc., Baltimore, Md.....	140
U	
Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y.....	321
*Union Drawn Steel Co., Beaver Falls, Pa.....	208
Union Twist Drill Co., Athol, Mass.....	245
United Lead Co., 111 Broadway, New York, N. Y.....	202
United States Gauge Co., 67 Wall St., New York, N. Y.....	326
V	
Van Dorn & Dutton Co., Cleveland, O.....	141
Van Dorn Electric Tool Co., Cleveland, O.....	141
Vasil Steam Systems Co., Hudson, Mass.....	63
*Veeder Mfg. Co., Hartford, Conn.....	341
*Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis.....	277
Vogt Machine Co., Henry, Louisville, Ky.....	55
W	
Ward Engineering Works, Charles, Charleston, W. Va.....	56
Ward's Sons, Edgar T., 50 Farnsworth St., Boston, Mass.....	209
*Warner & Swasey Co., Cleveland, O.....	225
Washburn & Granger, 50 Church St., New York, N. Y.....	72
Webster & Co., Warren, Camden, N. J.....	80, 81, 82, 83
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill.....	180, 181, 182
*Weston Electrical Instrument Co., Waverly Park, Newark, N. J.....	333
Wetherill & Co., Inc., Robt., Chester, Pa.....	19
Wheeler Mfg. Co., C. H., Philadelphia, Pa.....	85
Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y.....	210
*Wickes Boiler Co., Saginaw, Mich.....	57
Willcox Engineering Co., Saginaw, Mich.....	317
Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill.....	302, 303
Williams, White & Co., Moline, Ill.....	215
*Wood & Co., R. D., Philadelphia, Pa.....	294, 295
*Wood's Sons Co., T. B., Chambersburg, Pa.....	150, 151
Worthington Pump & Machinery Corp'n, 115 Broadway, New York, N. Y. 26, 86, 276, 291	
Wyckoff & Son Co., A., Elmira, N. Y.....	122

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

**CATALOGUE SECTION
PART I**

Power Plant Equipment

9

Pages 10-134

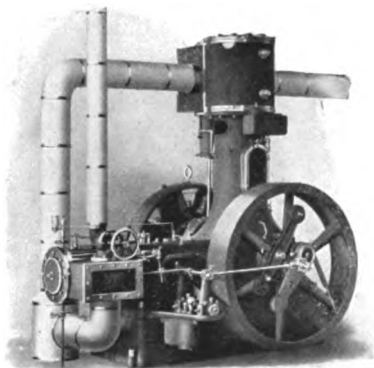
AMERICAN ENGINE & ELECTRIC CO.

WORKS AND OFFICES

BOUND BROOK, N. J.

Manufacturers of All Kinds of Simple and Compound Steam Engines, for Direct-Connected or Belted Service

THE AMERICAN-BALL ANGLE COMPOUND ENGINE



The American-Ball Angle Compound Engine has all of the advantages possessed by every American engine, an automatic system of lubrication, sensitive balanced automatic governor, adjustable cross-head guides, attached indicator reducing motion, high-class workmanship, etc. Besides these, some of the special advantages inherent to the angle construction are as follows:

With the cylinders at right angles, practically perfect balancing is secured. The Angle construction, with its four impulses per revolution, gives a practically uniform torque, making this engine especially adaptable for driving alternators which are to be run in parallel. Small floor space. The Angle Compound Engine gets twice as

much power on the same amount of floor space as does a simple engine.

DIMENSIONS OF AMERICAN-BALL ANGLE COMPOUND ENGINES

FOR DIRECT-CONNECTED SERVICE

K. W.	Cylinder Diameters and Stroke	Revolutions per Minute	Floor Space		Steam and Exhaust Pipes		Shipping Weight in Pounds
			Length	Width	Steam	Exhaust	Direct Connected Engine
75	12 & 19 x 10	325	103	107½	4	6	12,200
100	13 & 20 x 11	300	111	112	4	7	15,200
150	16 & 25 x 12	285	125	120½	6	9	21,400
200	18 & 28 x 14	260	138	132½	6	10	27,900
250	20 & 32 x 15	250	145	156½	7	12	31,700
300	22 & 34 x 16	240	154	165	8	12	39,200
400	25 & 38 x 18	225	164	174	9	14	51,000

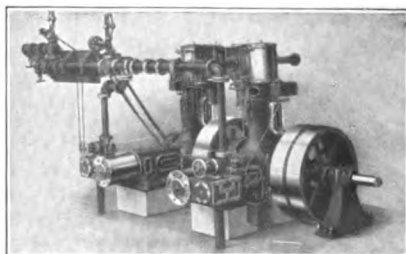
THE AMERICAN-BALL FOUR-CYLINDER PAPER MILL ENGINE

has the following important advantages:

A speed range of 8:1 and even 10:1, permitting of direct connection to the variable speed shaft.

Elimination of shut-downs to change speed.

Excellent speed regulation secured by the four-cylinder construction of the engine and by a special stabilized governor which prevents surging in speed and insures even thickness of paper.



Ask for literature on Paper Mill Engines and Engines for Isolated Plants, also our report on cost of Isolated Plant Power.

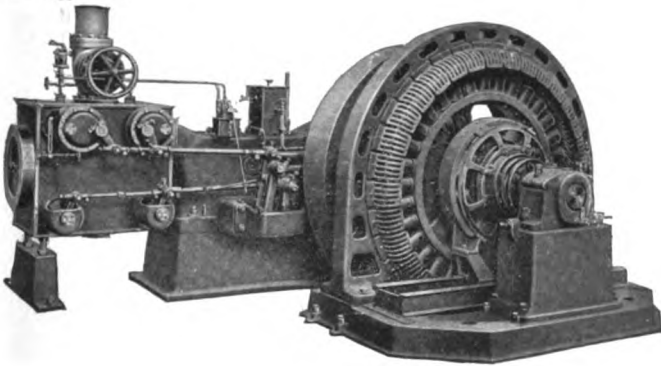
BALL ENGINE CO.

ERIE, PENNSYLVANIA

Builders of Corliss-Valve and Single-Valve Engines; Horizontal and Vertical Side-Crank Engines; Tandem and Cross-Compound Single-Valve Engines, Corliss-Valve Compound and Single-Cylinder Engines

BALL HIGH-SPEED CORLISS ENGINES

The feature which distinguishes this engine from other four-valve shaft-governed engines is the patented non-detaching valve gear, which imparts the same movement to the valves that the drop cut-off of the slow-speed Corliss produces by picking up and dropping them. This permits the use of the best form of valve, and the valves are given the movement necessary for the greatest durability and tightness.



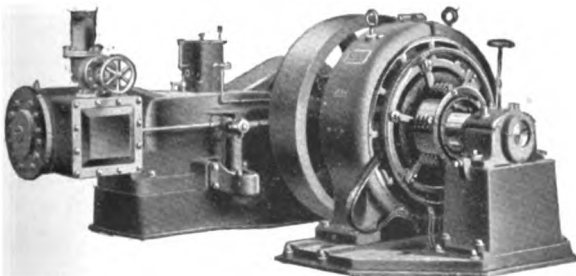
Horizontal Single-Cylinder Side-Crank Engine—Corliss Type

Built in sizes from 100 H. P. to 1600 H. P. in the single-cylinder and cross-compound types.

These engines excel in economy and regulation and are especially adapted for electric service.

BALL SINGLE-VALVE AUTOMATIC ENGINES

These engines are the result of a long experience in building engines for electric service. They are superior in design and construction. The regulation and economy are the best of their type.



Single-Cylinder Side-Crank Engine—Single-Valve Type

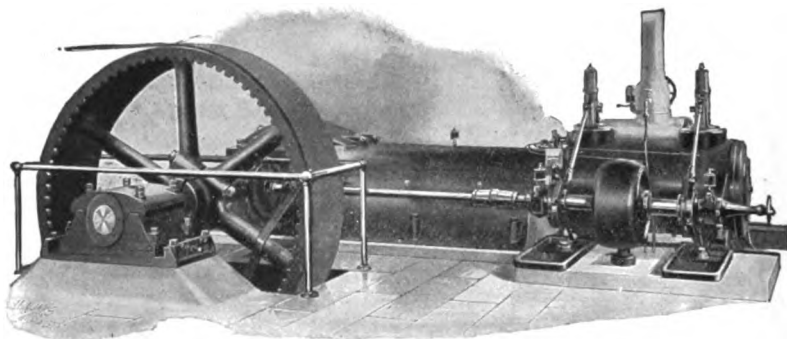
Built in sizes from 25 H. P. to 800 H. P. in the single-cylinder, tandem-compound and cross-compound types.



ERIE CITY IRON WORKS

ERIE, PENNA.

Manufacturers of Steam Engines and Boilers and Feed Water Heaters; Horizontal and Vertical Water Tube Boilers; Lentz Engines



THE LENTZ ENGINE

A Provision for the Necessity Confronting American Manufacturers for Economy in the Use of Fuel

We are approaching a condition in this country that exists in other countries, that is: *extreme economy must be practised in every department of every business to make a fair showing*, and this applies with especial force to the coal pile.

After an extended investigation we have become convinced that the Lentz engine, using superheated steam, is the most economical of all prime movers, and have secured the American rights for manufacturing it under the patents of Hugo Lentz, of Germany.

CONSTRUCTIONAL FEATURES

Throughout the engine there is no elastic packing used. The valves are of the double-seated poppet type, and the valve spindles are ground to fit in long bushings with water grooves, and no packing is used in this construction. The valve is so designed that it can stand high temperature or changes of temperature without affecting its tightness, and as there is no rubbing surface it stands equally well under a high degree of superheat or saturated steam. The valves are actuated by a cam working on a roller, these parts being all case hardened. When the valve comes to a seat the cam is disengaged, but the roller and cam are always in contact until the valve has been seated; consequently, there is no noise, nor is there any limit to the revolutions at which the valve gear may be run.

The governor is extremely simple in its construction; consisting of an inertia weight, two pendulæ and one small flat spring. It utilizes its inertia in a very novel and unique manner. The outer ring, running loose on the lay shaft instead of being rigidly connected to it, as is the case in most other governors, influences directly the governor spring and the pendulæ. With the slightest change of load and consequently of speed, this inertia force acts before the centrifugal forces which have to first overcome the friction existing before they can possibly become operative. The consequence of this novel combination of inertia and centrifugal action is a greatly increased sensitiveness and quickness in action.

When required, the engine is provided with a hand-speed adjustment, and the speed of the engine can be varied while in operation. As noted in the illustration above, the engine is extremely simple and very accessible. All details have been fully patented by Mr. Hugo Lentz of Germany, and we have the exclusive rights under these patents in the United States.

We are prepared to demonstrate that this is the most economical steam engine that has ever been made. We have offices in all the important centers, and it would be a pleasure for us to have a representative call and go into the details of this engine. This engine is built single cylinder, tandem and cross-compound.



THE FITCHBURG STEAM ENGINE CO.

Established 1871

FITCHBURG, MASS.

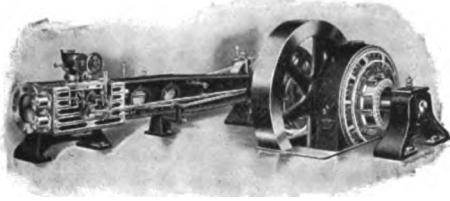
NEW YORK
PHILADELPHIA

BRANCH OFFICES
CHATTANOOGA

CHICAGO
SAN FRANCISCO

Manufacturers of Steam Engines for Use under Every Sort of Condition

"THE FITCHBURG"—DIRECT-CONNECTED—GIRDER BED



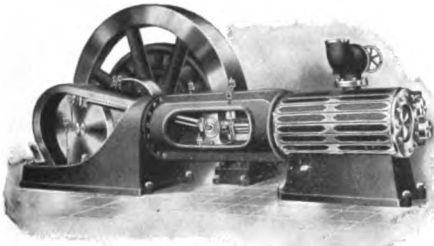
Sizes 7" by 18" to 22" by 42". Revolutions 80 to 250.

D. Con. or Belted Girder Bed as above	To 300 H. P.
" " " " Tangye Bed as below	" 800 "
" " " " Tandem Girder	" 300 "
" " " " Tandem Tangye	" 800 "
" " " " Cross Girder	" 750 "
" " " " Cross Tangye	" 1500 "
" " " " High-Speed Horizontals	" 250 "
" " " " Single Cylinder Vertical	" 400 "
" " " " Steeple Comp'd Vertical	" 400 "

Details for any size given on application.

13

"THE FITCHBURG"—DIRECT-CONNECTED—TANGYE BED



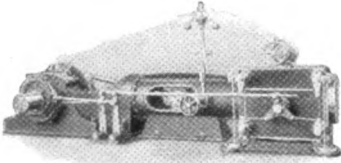
Sizes 12" by 18" to 30" by 48". Revolutions 80 to 250.

Also the Fitchburg-Prosser Engine. Better economy guaranteed with single cylinder than can be obtained from best compound engines under same steam conditions.

HARDIE-TYNES MANUFACTURING COMPANY

BIRMINGHAM, ALABAMA

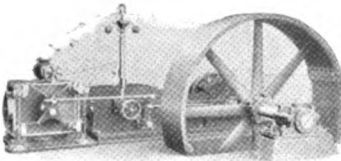
Manufacturers of Corliss Engines, Hoisting Engines, Direct-Connected Engines, Slide Valve Engines, Air Compressors, Special Machinery, Heavy Castings



HEAVY DUTY CORLISS ENGINES

Tangye Frame Type

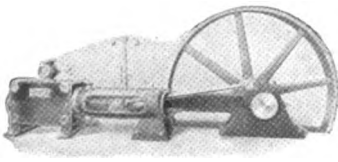
Designed for steam pressures of 150 lb. or more, to run at moderate speeds. Built in sizes ranging from 16 x 36 in., 114 i.h.p., to 34 x 60 in., 1255 i.h.p.



HEAVY DUTY CORLISS ENGINES

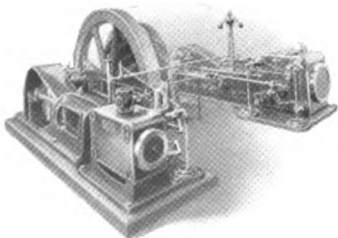
Imperial Frame Type

These engines are also designed for steam pressures of 150 lb. or more, but may be operated at somewhat higher rotative speeds than the Tangye Frame Machines. Sizes range from 8 x 20 in., 21 i.h.p., to 22 x 30 in., 550 i.h.p.



HEAVY GIRDER FRAME CORLISS ENGINES

These engines are especially suitable for manufacturing plants having moderate steam pressures and no suddenly applied overloads. Designed for steam pressures of 150 lb. or less, and built in sizes ranging from 12 x 24 in., 52 i.h.p., to 26 x 48 in., 780 i.h.p.



COMPOUND CORLISS ENGINES

Cross and Tandem Types

Are built on either Tangye, Imperial or Girder Frames. Sizes range from 400 i.h.p. to 2300 i.h.p., 65 i.h.p. to 700 i.h.p., 135 i.h.p. to 1300 i.h.p., respectively.

DIRECT CONNECTED CORLISS ENGINES

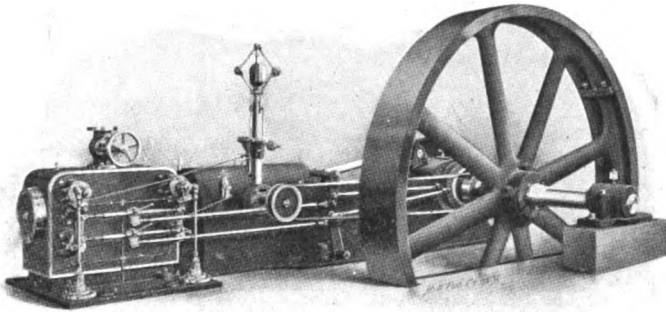
Are built on both Tangye and Imperial Frames for service with either direct or alternating current generators, from 50 to 1500 k. w. capacity.

HARRIS-CORLISS ENGINE AND MACHINE COMPANY

PROVIDENCE, R. I., U. S. A.

**Builders of Harris-Corliss Engines. Remodeling and Repairing of Engines.
Mill Repairs and Machine Work. Special Machinery**

IMPROVED HARRIS-CORLISS ENGINES with Brown Patented Releasing Valve Gear



Valve Gear Side Simple Harris-Corliss Engine, Extra Heavy Duty Type

15

The durability and economy of Harris-Corliss Engines are phenomenal. Second hand units command good prices and are always in demand. When rebuilt they carry the same guarantees as new engines.

Built in all sizes from 15 to 2500 H. P.

REBUILDING AND REPAIRING ENGINES

Break-Down Jobs Given Special Attention

Mill Repairs, Shafting and Machine Work

LATHES

**Special Machinery Built
To Order**



MURRAY IRON WORKS CO.

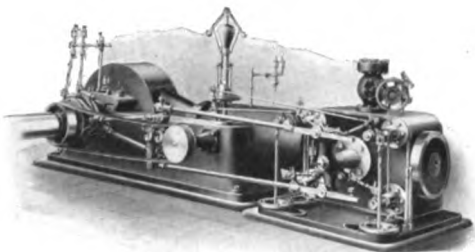
1870

BURLINGTON, IOWA

1916

Complete Power Plants—Corliss Engines—Boilers of All Types—Air Compressors, Pumping Engines, Feed Water Heaters, Rocking Grates

MURRAY CORLISS ENGINES



Murray Rolling Mill Type Corliss Engine

Murray Corliss Engines are built either with girder frame, tangye frames or rolling mill frames of our patented design. The **Standard Murray Corliss** is a girder frame engine built in sizes up to 18 x 42 inches, and capacities ranging from 50 to 600 H. P. **Murray Tangye Frame Corliss Engines** for extra heavy duty are built in sizes from 16 x 36 inches upward. Our **Rolling Mill**

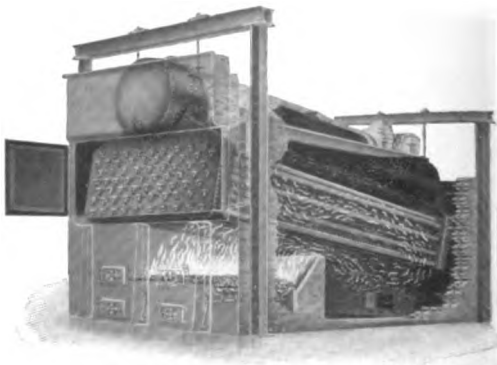
Type Frame for high pressures and high speeds is built for engines from 12 x 24 inches upwards. Capacities range from 100 to 1300 H. P. Tandem and Cross Compound Engines are built for any load required. **Murray Minor Corliss Engines**, 20 to 70 H. P., are suitable for the smaller mills and factories. Ask for Catalogue No. 65.

Points of Superiority: A. Excellence of materials. B. Best workmanship. C. Rigid inspection. D. Superiority of design in the following particulars of detail: 1. The latest and most approved forms of frames, suitable for every purpose. 2. High speed, ball-bearing governor with improved safety stops. 3. A form of cylinder whereby the exhaust passages are insulated from the cylinder by a dead air space. 4. Improved valve motion. 5. Improved dash pots, under the cylinder plate, or bolted to side of cylinder. 6. Improved forms of steam and exhaust valves. (Double ported when specified.) 7. An improved form of piston. 8. Fly wheels made in halves, free from initial strains. 9. Vertically adjustable outer pillow block with oil-retaining rim. 10. Broad pyramidal main bearing and cylinder feet or sole plates. 11. New and improved style connecting rod. 12. Improved cross head with adjustable shoes running in bored guides. 13. Smallest possible clearance volume.

HIGH PRESSURE MURRAY BOILERS

The essential features of the **Murray Water-Tube Boilers** are safety, simplicity, accessibility and economy of fuel and space. They are of the straight tube, all steel type, no cast iron being used in any part subject to tensile strain. They are made up of front and rear headers connected together with wrought circulating tubes and a top steam drum or drums, the whole set with an incline to the rear in an inexpensive bricksetting, those of 200 H. P. capacity and over being supported independently of the brick work by a cast iron column and steel girder gal-lows frame as shown.

We do not confine our customers to one type, but build the Tubular, the Water-Tube and the Internal Furnace. These different types of boilers are described in the following: *Water - Tube* — Catalogue No. 60; *High Pressure Horizontal Tubular* — Series "D," No. 4 Pamphlet; *Standard Horizontal Tubular* — Series "D," No. 6 Pamphlet; *Scotch Marine* — No. 75 Pamphlet; *Vertical and Portable* — Series "D," No. 10 Pamphlet.



Murray Water-Tube Boiler, with Suspension Rigging

NORDBERG MFG. CO.

MILWAUKEE, WIS.

Engineers and Designers of High Efficiency Poppet Valve Engines, Poppet Uniflow Engines; Corliss Engines, High Compression Oil Engines, Nordberg-Carels Diesel Engines, Air Compressors, Blowing Engines, Steam and Electric Hoists, Pumping Engines and Steam Stamps

POPPET VALVE ENGINES

Nordberg Poppet Valve Engines operate with steam consumptions as low as 16 lbs. per H. P. hour non-condensing. These engines are of high speed design with new type of valve gear, and are built especially for use with high pressure superheated steam.

POPPET VALVE UNIFLOW ENGINES

These engines have Poppet steam valves, but exhaust through ports in the cylinder wall uncovered by the piston. A single-cylinder Uniflow Engine gives the same economy as an ordinary compound condensing engine.

CORLISS ENGINES

Nordberg Corliss Engines are built in all sizes with both the standard and Long Range valve gears.

HIGH COMPRESSION TWO CYCLE OIL ENGINES

This is the simplest oil engine on the market today. There are no valve gears or valves subject to the working pressure and heat. The only valve is a low pressure piston valve for scavenging air.

NORDBERG-CARELS DIESEL ENGINES

In large sizes up to and including 1500 H. P., the Nordberg Company build Diesel Engines under patents of Carels Freres, who have built more large Diesel Engines than any other company in the world.

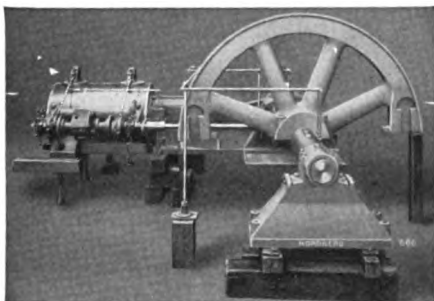
ELECTRIC HOISTS

Nordberg Electric Hoists are built from new designs throughout. The Nordberg drum, clutch and brake designs, developed in 25 years of experience with Nordberg Steam Hoists, have been incorporated in these designs.

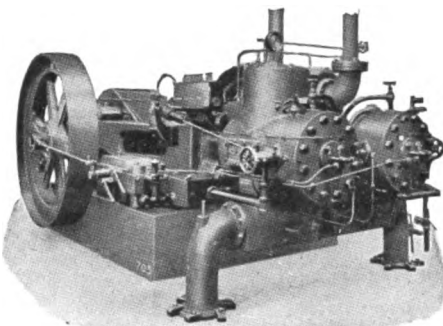
STEAM HOISTS

Nordberg Steam Hoists are well known to all mining men. Practically all of the large hoists for high speeds and great depths have been built by the Nordberg Co. All of the successful compound condensing steam hoists are of Nordberg make.

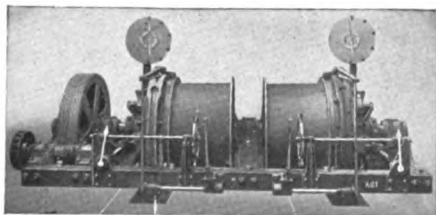
Bulletins on any products sent upon request.



Nordberg Poppet Valve Engine. The Valve Gear Opens and Closes the Valves Positively without the Use of Springs or Dash Pots, by Cams Oscillated by Eccentrics



Nordberg 200 H. P. High Compression Oil Engine, Twin Cylinder Design. The Simplest Engine for Direct Connection to Generators, Pumps, Etc., or for Belt Drive



Typical Nordberg Two-Drum Hand Operated Electric Hoist. The Axial Plate Clutches Are Operated by a Worm Wheel and Sector and the Gravity Foot Brakes by Hand Lever. Note Pointer Showing Position of Clutch

SKINNER ENGINE COMPANY

ERIE, PA., U. S. A.

Branches in 32 Cities

Builders of High Grade Automatic Engines

THE "UNIVERSAL UNAFLOW"



THE MOST ECONOMICAL STEAM ENGINE EVER BUILT

Any engine will *operate* noncondensing and condensing; but the "UNIVERSAL UNAFLOW" is the only engine that will give *maximum economy* under both conditions, because it is

THE ONLY UNAFLOW ENGINE:

That operates noncondensing, as well as condensing, with *small clearances*.

That automatically changes, while in operation, from a condensing to a non-condensing engine, and *vice versa*, with changes of exhaust pressure, giving the maximum economy under both conditions.

That has expanding poppet valves which remain STEAM-TIGHT under all temperature and pressure changes.



This engine has demonstrated its economy over other makes of engines, and against outside current, in over one hundred power plants.

Built Only
Because Patented } by Skinner Engine Co.

Write for new catalogue.

ROBT. WETHERILL & CO., INC.

Established 1872

CHESTER, PA.

Manufacturers—Power Plants, Elevators, Corliss Engines, Heavy Machinery, Boilers, Heaters, Plate Metal Work, Marine Engines, Boilers, Shafting, Etc.

WETHERILL CORLISS ENGINES

These include Heavy Duty and Girder Type Corliss Engines, Single Cylinder and Compound, adapted to the exacting requirements of alternating and direct-current work for any service—Rolling Mills, Pumping Engines, Air Compressors or any installation where reliable power is required.



Our Gravity Type Valve Gear (patented) is designed for high rotative speeds, applicable to office building installation; smooth and noiseless in operation. All valve gear details with accurate wedge adjustment; no driven keys used in the construction.

Corliss Engines built any size and capacity, from 50 H. P. to 5000 H. P.

ELECTRIC AND PLUNGER ELEVATORS

For Passenger and Freight Service

Our Elevator Department is equipped with the most modern tools for the production of both types of elevators, for high-speed passenger and freight service.

Our recent installation of Plunger Elevators in the Hotel McAlpin, 33rd Street and Broadway, New York City, may be said to represent the latest development and patents in Plunger Elevator construction. We also supplied the Well Rooms with Improved Automatic Valves, Oil Buffers, and our Corliss Three-Cylinder High-Duty Crank and Fly Wheel Type Pumping Engine for Elevator Service. Plungers and cylinders are of specially selected heavy steel tubing; plungers finished to micrometer gauges, insuring minimum friction losses and long life.

Where local conditions are such that the Electric Type is to be installed, our Improved Electric Traction Machine is used, designed for high-speed service, of the Worm-Gear Traction Type, with modern method of roping. Thirty-three of this type of Elevator were installed by us in the new Municipal Building, Center and Chambers Streets, New York City.

STEEL PLATE DEPARTMENT

Our Steel Plate Department is equipped with Traveling Cranes and Hydraulic Riveters. Punches and tools for the manufacture of heavy steel plate construction—Boilers, Tank Work and Stacks; and Kilns, Coolers, Dryers, Storage Bins, etc., for Cement Mills.

Heavy Machinery estimated on and constructed from engineers' designs.

BUSCH-SULZER BROS.-DIESEL ENGINE COMPANY

ST. LOUIS, MO.

SALES OFFICES:

MINNEAPOLIS, 754 Plymouth Bldg.

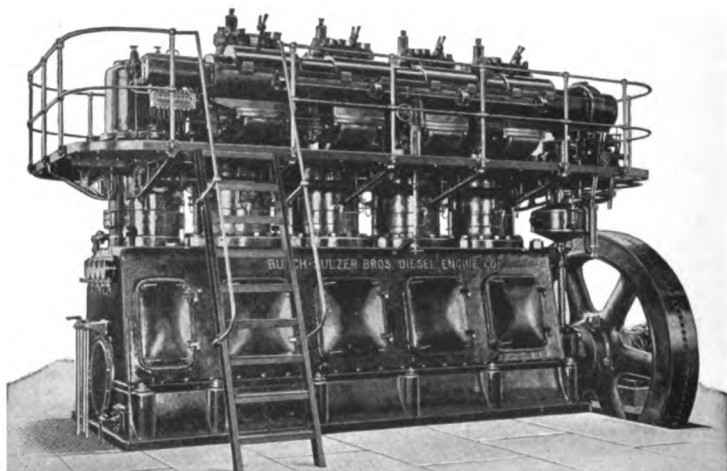
Southwest Sales Agents:

SAN FRANCISCO, 419 Rialto Bldg.

YORK ENGINEERING & SUPPLY CO.

OKLAHOMA CITY, 205 State National Bank Bldg.

Houston, El Paso, Fort Worth, New Orleans



STANDING: Original manufacturers of the Diesel Engine in America. We can refer you to satisfied users of nearly 100,000 H. P. of Diesel Engines built by us during the past fifteen years, in plants of from 120 H. P. to 3600 H. P. installed in Central Stations, Pumping Plants, Flour Mills, Ice Plants and Industrial Plants.

MANUFACTURING FACILITIES: New manufacturing plant at St. Louis specially designed and equipped for building of high grade Diesel Engines—devoted solely to building Diesels.

QUALITY: Long years of experience in design, the selection of raw materials, the requisite refinement in manufacture afforded by adequate shop facilities, insure reliability, low upkeep and long life.

PRICES: Groups of engines of standard sizes are brought through factory on shop order—thus reducing manufacturing costs as low as is commensurate with quality of product.

TYPE AND SIZES: Type B—vertical—four-cylinder—single acting—4-stroke cycle. Sizes—120 H. P., 165 H. P., 250 H. P., 365 H. P., 520 H. P. Medium speeds—suitable for belt, rope, or direct coupled drive.

Type B supersedes Type A, is equipped with compressor built integral, shaft maintained in factory alignment by rigid bearings, forced feed lubrication, etc., etc. Type M Marine Diesel Engines—particulars on request.

PUBLICATIONS: Diesel Engine performance bulletins and operating records in Central Stations, Water Works, Ice Plants, Flour Mills, Industrial Plants, gladly mailed on request.

FULTON IRON WORKS

Established 1852

Incorporated 1871

MAIN OFFICE AND WORKS, ST. LOUIS, MO.

Builders of Fulton-Tosi Oil Engines Diesel System, Corliss and Medium Speed Steam Engines

FULTON-TOSI OIL ENGINES (Diesel Type)

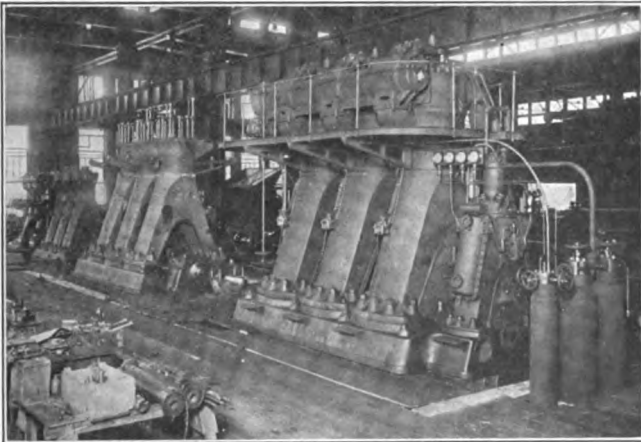
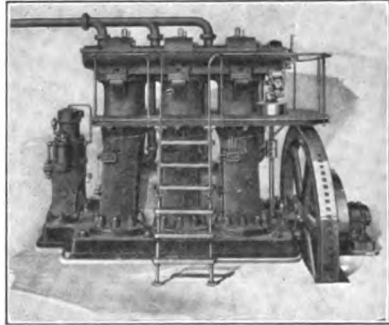
The Fulton-Tosi Four-Cycle Oil Engine is built in the vertical form, "A" frame, and in two, three and four cylinder arrangement. The engine is designed to operate on the cheapest petroleum, crude or fuel oils, or tar oils, with greatest reliability and economy, and as ignition is insured by the heat of compression, no hot bulb, electric spark, or other exterior means of ignition is required.

The engine may be started up from cold within one minute, without any troublesome or time-consuming preliminaries.

The operation of the engine is comparatively quiet, very clean and perfectly safe, permitting of its installation almost anywhere. Tanks for the storage of fuel oil may be buried under buildings, driveways, or in any other convenient location, without interfering with the use of the space above for other purposes.

The Fulton-Tosi Four-Cycle Oil Engine is built in sizes ranging from 100 B.H.P. in two cylinders to 800 B.H.P. in four cylinders. These engines are suitable for any power purpose, including electric light and power plants, water works, flour mills, textile mills, irrigation plants, etc. Where the requirements as to regularity of speed are extremely exacting, we recommend the selection of an engine with at least three cylinders.

Bulletin 800 giving details will be gladly forwarded upon request.



Diesel Engine Erecting Floor

Fulton-Corliss Steam Engines are built in horizontal and vertical types; simple, tandem, or cross compound up to 3000 H.P. This is probably the heaviest line of releasing gear Corliss engines built in America.

For higher speed work we build a line of non-releasing gear Corliss valve engines, the steam economy of which corresponds closely to that of the low speed releasing gear line.

"Over sixty years of successful manufacturing."



McINTOSH & SEYMOUR CORPORATION

AUBURN, N. Y., U. S. A.

BRANCH OFFICES

**NEW YORK CITY, 50 Church Street
EL PASO, 809 Mills Bldg.
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HAVANA, CUBA, O'Reilly 30
MANILA, P. I., Pacific Commercial Co.**

**WASHINGTON, Southern Bldg.
KANSAS CITY, 717 Dwight Bldg.
ST. LOUIS, 2086 Railway Exchange Bldg.
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SAN FRANCISCO, 514 Sheldon Bldg.**

Manufacturers of Diesel Type Oil Engines

McIntosh

&

Seymour

Type A

Engine

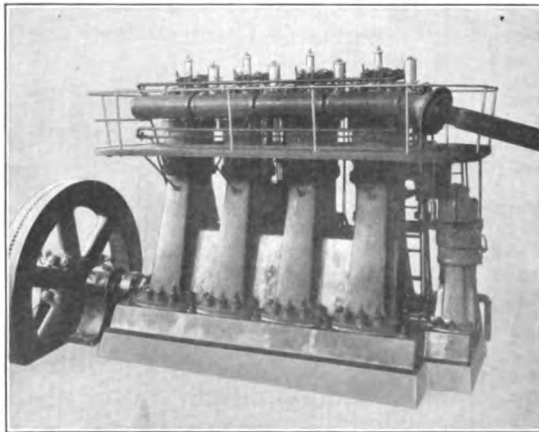
of

500

Brake

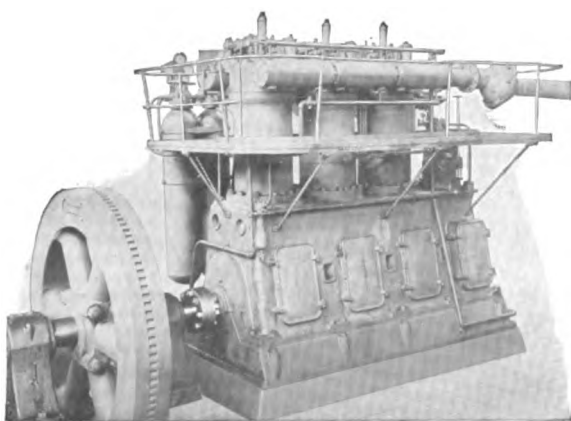
Horse

Power



These engines are built from the standard designs of the Swedish Diesel Engine Co. of Stockholm who have placed large numbers of both their marine and stationary types in most successful operation throughout Europe.

We are building a wide range of sizes that are adapted for mechanical drive or direct connection to electric generators. Descriptive bulletins, and data on our installations sent on request.



McIntosh

&

Seymour

Type B

Engine

of

285

Brake

Horse

Power

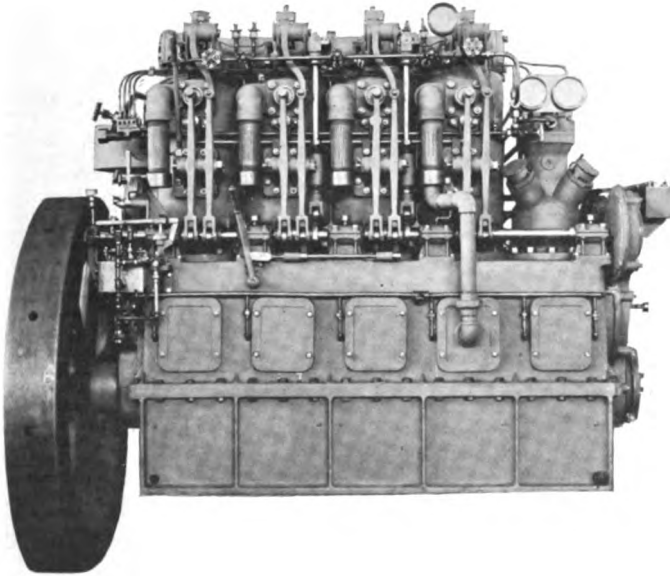
NEW LONDON SHIP & ENGINE CO.

GROTON, CONN., U. S. A.

Manufacturers of Stationary and Marine Diesel Engines

NLSECO DIESEL ENGINES

Burn the same cheap fuel oil, or crude, as is commonly used under steam boilers. Consumption, 6 gallons per 100 H. P. per hour.



120 H. P. Four Cycle NlsecO Diesel Crude Oil Stationary Engine

NlsecO Diesel engines are always ready for instant starting.

They are fitted with governors designed for a speed variation of 3% from full load to no load.

They are simple in design, construction, and operation—and the upkeep is very low.

Over 40,000 H. P. in Service

*Gold Medal of Honor—Panama Pacific Exposition
Adopted by United States and Foreign Governments*

SIZES: 120, 180, 240, 360, 480, 600, 800, 1200 to 2500 H. P.

Stationary and Marine Types.

Write us your requirements.

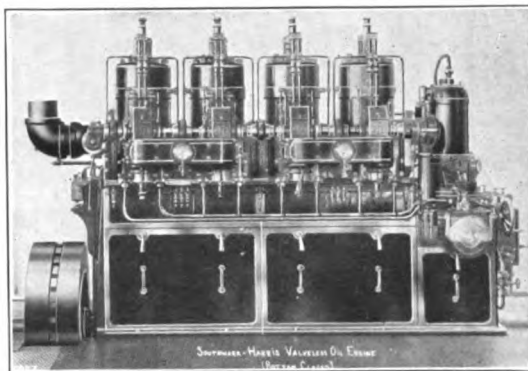


SOUTHWARK FOUNDRY & MACHINE COMPANY

PHILADELPHIA, PA.

Builders of Hydraulic Machinery for Every Service; Large Power Tools; Turbine and Blower Equipment; Cut-Off Machines, Southwark-Harris Valveless Engines (Diesel Principle) for Marine and Stationary Use

We install complete **HYDRAULIC PLANTS** comprising Presses—all types and sizes; Pumps, Accumulators, Intensifiers, Valves, etc., and will submit estimates on receipt of details.



**From Stone Cold to FULL POWER in 10 Seconds
Entire Control Centralized in One Hand Wheel**



**Double-Acting 'Drawing
Press for Deep Stamp-
ing Work**

The **SOUTHWARK-HARRIS Valveless Engine (Diesel Principle)** characterized by an Eminent European Diesel Engine Authority, after careful inspection, as the "SIMPLIFIED DIESEL."

These engines, which are built in sizes 120 to 2000 I. H. P., 2-, 4-, 6- and 8-cylinder units, are the highest development of the Diesel principle, with many exclusive features of established merit.

All trouble-making valves have been eliminated; all parts readily accessible.

Operating on the cheaper grades of crude or fuel oil, the cost of operation is from one-fifth to one-third cent per horse-power per hour.

Complete data on request.

DE LA VERGNE MACHINE CO.

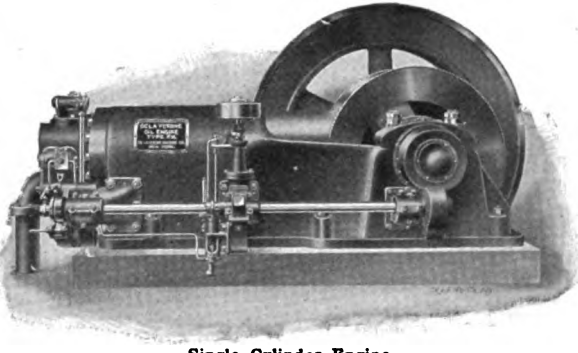
1123 EAST 138TH STREET, NEW YORK CITY

De La Vergne Crude Oil Engines, Refrigerating Machinery, Ice Machines

TYPE "FH" CRUDE OIL ENGINE

De La Vergne oil engines have been developed over a period of 20 years in the United States to meet American conditions.

They operate on the lowest grades of crude oil and also on waste residual tar by-products which cannot be economically used in any other known way. This ability to operate on the cheapest grades of fuel together with their remarkably high economy makes the De La Vergne oil engines the most economical form of power known.



Single Cylinder Engine

They are of the medium pressure type and the wear and tear caused by high compression and explosion pressures are entirely eliminated. Every part is within easy reach from the floor and the design is distinguished by its few parts and remarkable simplicity throughout.

Skilled engineers are not required and the engine operates with only ordinary attention.

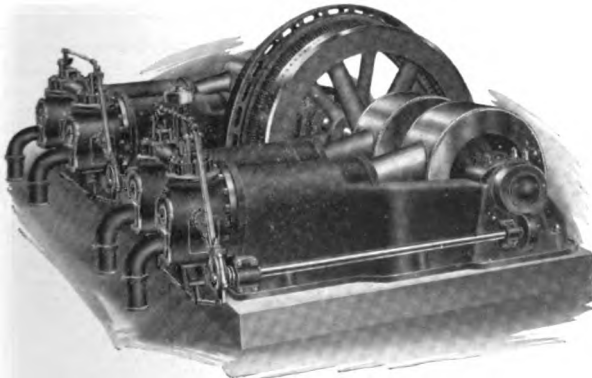
Guaranteed—to operate on any commercial fuel or crude oil produced in the United States or in Mexico, to develop 19 B. H. P. hours per gallon of fuel when running at $\frac{3}{4}$ to full load.

Advantages—no excessive pressures, low cost of operation, no stand-by losses, no handling of coal or ashes, absolute reliability, minimum expense for attendance and upkeep.

Application—electric lighting, pumping, air compressors, refrigerating machines, factory service, mining, etc., in fact, any place where power is required.

Sizes—Built in one, two and four cylinder units from 40 B. H. P. to 800 B. H. P.

Full details in bulletin No. 138—sent on request.



Four Cylinder Engine

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

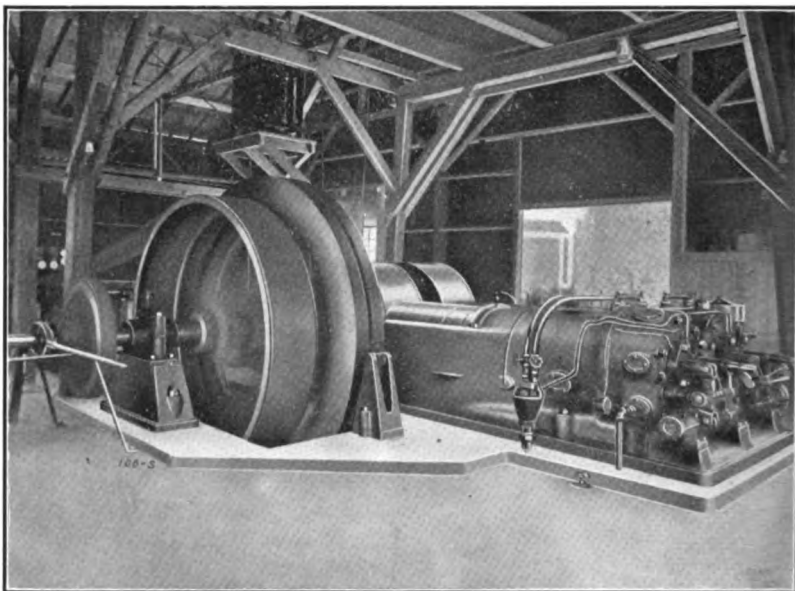
SNOW WORKS: Buffalo, N. Y.

Branch Offices in All Principal Cities

Snow Oil Engines

Snow Gas Engines

Gas Engine Gas Compressors—Oil Line Pressure Pumps



The Snow Oil Engine—A Self-contained Power Plant

The SNOW Oil Engine is a high compression type liquid fuel engine. It is positively not an explosive engine.

No ignition apparatus necessary.

No explosion shocks to be absorbed, with the results that the life of the engine is much longer than that of any other type of liquid fuel engine.

The liquid fuel is sprayed into highly compressed air, the heat of which ignites the oil. Complete combustion follows.

The spray nozzle or atomizer thoroughly converts into fine spray the heaviest grades of asphalt base crude oils and residuums from Mexico and California, as well as the lighter liquid fuels from the Eastern and Mid-Continent fields.

Three or four gallons of cooling water per B.H.P. hour are required for the SNOW Oil Engine. Under normal operating conditions the discharge temperature of the water may be 140° F.

All SNOW engines are rated conservatively, and ratings are based on their operation at sea level; the power being measured on the shaft and engines guaranteed to develop 10% overload during periods of two hours' duration.

We make a standard guarantee on our four-cycle engine, when operating on any Crude Oil, Distillate or Fuel Oil obtainable in the United States or Mexico, of the following qualities, the power being measured on the engine shaft, and the fuel to have a lower heat value of not less than 18,000 B.T.U.'s per pound, containing not over 1% of water:

Full load, .5 lb. per B.H.P. hour

$\frac{3}{4}$ load, .52 lb. per B.H.P. hour

$\frac{1}{2}$ load, .6 lb. per B.H.P. hour

Ask for a copy of Catalog S130-68 (for Operating Characteristics). S 208.8

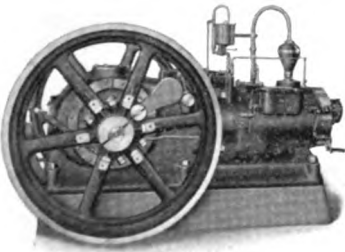
AUGUST MIETZ MACHINE WORKS

123 Morr St., NEW YORK

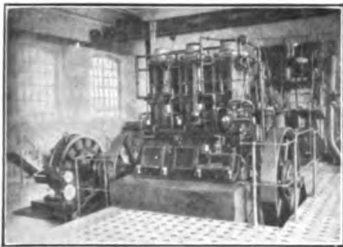
Manufacturers of Oil Engines, Marine and Stationary, Direct Connected or Belted to Generators; Air Compressors; Pumps; Hoists

Our Engines, both Stationary and Marine, received the **HIGHEST AWARD** for injection type oil engines at the Panama-Pacific International Exposition.

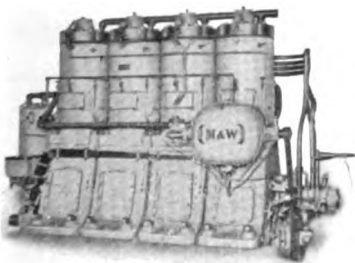
**STATIONARY AND MARINE, 2 TO 600 H. P.
DIRECT REVERSIBLE MARINE ENGINES 75 TO 600 H. P.**



50 and 75 H. P. Horizontal Engine



150 H. P. Generator Set



200 H. P. Marine Engine

Over 250,600 H. P. in Operation

These engines are operated at moderate compression pressures and medium speeds, consuming approximately one gallon of crude oil or other fuel per ton horsepower hours, at a cost of three cents. The smaller sizes generally run with kerosene.

They are two-cycle heavy-duty engines, extremely simple, and, equipped with our steam cooling system, the reliability and durability are equal to the modern steam engine. The steam generated in the water jacket of the cylinder enters the combustion space and is compressed with the charge.

Our Engines are used for all power purposes, pumping and electric light plants either direct or belted to generators, operating in parallel.

The Direct Reversible Marine Engines are rigidly connected to the propeller shaft, without fly wheel and fitted with the S & W Air Distributor. They are controlled by a lever to stop or start the engine in either direction by compressed air through most reliable and positive mechanism.

NATIONAL METER COMPANY

Established 1870

84-86 CHAMBERS ST.

NEW YORK CITY

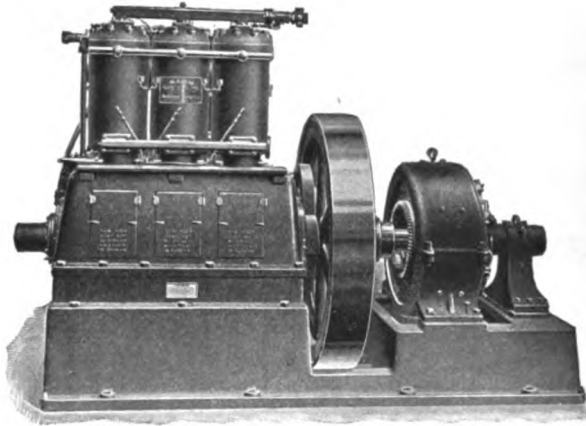
Manufacturers of Water Meters and Gas Engines

NASH GAS ENGINES

To Operate on Illuminating Gas, Gasoline or Producer Gas
Simple, Silent, and Efficient

The engine throughout is the embodiment of the latest and best ideas of gas engine design and construction.

Is of very liberal proportions and high grade in every detail. The NASH has many exclusive and valuable features.



All sizes of NASH engines are of the four-cycle type and are fitted with throttling or hit and miss governors as may be selected or best suited to the conditions.

The National Meter Company is the originator of the throttling governor for gas engines and the NASH was the first gas engine to be equipped with it.

In regulation, the NASH Gas Engine is on a parity with that of the best steam engines.

Due to its high economy, closeness of regulation and quietness of operation it meets a great range of power requirements.

Manufactured in all sizes from 25 to 300 H. P.



COMPARATIVE COST OF POWER OF VARIOUS TYPES OF ENGINES

TYPE OF ENGINE	Fuel	Price	Fuel Consumed per B. H. P. per Hour	Cost per H. P. per Hour	Cost 100 H. P. 10 Hrs.
Simple Slide Valve Steam.....	Bituminous Coal	\$3.50 per ton	8 lbs.	.0124	\$12.40
Compound Condensing Corliss.....	Bituminous Coal	3.00 per ton	3 lbs.	.0045	4.50
Steam Turbine.....	Bituminous Coal	3.00 per ton	3 lbs.	.0045	4.50
Oil Engine.....	Fuel Oil	.036c. per gal.	1 1/12 gal.	.003	3.00
Nash Gas Engine.....	Natural Gas	25c. per M	10 cu. ft.	.0025	2.50
Nash Gas Engine on Producer Gas.....	Coke	5.00 per ton	1 1/4 lbs.	.0031	3.10
Nash Gas Engine on Producer Gas.....	Lignite	1.75 per ton	2 lbs.	.00175	1.75
Nash Gas Engine on Producer Gas.....	Anthracite Buck	4.00 per ton	1 1/4 lbs.	.0025	2.50
Nash Gas Engine.....	Illuminating Gas	75c. per M.	18 cu. ft.	.0135	13.50
Nash Gasoline Engine.....	Gasoline	16c. per gal.	3/4 gal.	.02	20.00
Electric Power.....		3c. per KW hr.		.0225	22.50

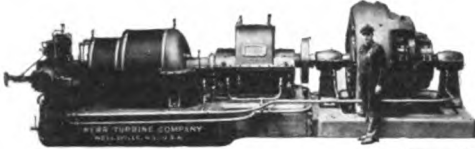
KERR TURBINE COMPANY

WELLSVILLE, N. Y.

Offices in All Large Cities

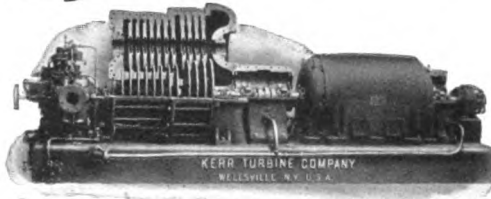
Manufacturers of 'Kerr Economy' Steam Turbines driving Generators, Pumps, Blowers, Shafting, Etc., and 'Kerr Economy' Herringbone Reduction Gears

'KERR ECONOMY' STEAM TURBINES combine low first cost and minimum operation expense; require little floor space; are very economical in steam consumption; have practically no vibration, and require little or no attention or repairs.



750 K. W. 'Kerr Economy' Geared Turbo-Generator, equipped with oil relay and emergency governors and forced feed lubrication to all main bearings

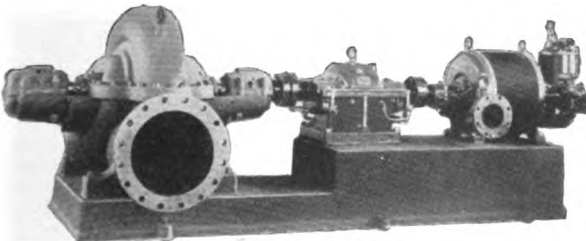
500 K. W. 'Kerr Economy' Turbo-Generator with horizontally split turbine casing, raised to show discs and rotor, and accessibility of parts. Note that the discs are completely exposed down to the shaft.



'KERR ECONOMY' TURBO-GENERATORS, PUMPS AND BLOWERS have proven their superiority in nearly every industry—coal and metal mining, power and pumping plants (private and municipal), paper manufacturing, glass making plants, steel plants, breweries, refineries, etc., as well as in Army and Navy use, marine installations, colleges, etc.

'KERR ECONOMY' HERRINGBONE REDUCTION GEARS have proven themselves to be the best, the most quiet, the most accurate and the most efficient built in the United States. Aside from making possible the low steam consumption and faultless operation of geared 'Kerr Economy' Steam Turbines driving low-speed generators, pumps, blowers and other machines, at their most efficient speed, they are also without equal for all classes of work requiring herringbone reduction gears.

The demand for 'Kerr Economy' products has become so great that it is necessary to build an extension to the factory, which will double our output.



'Kerr Economy' Turbo-Pump

Specify 'Kerr Economy' and Protect your Investment

Ask for your copies of our Bulletins



TRADE MARK

GENERAL ELECTRIC COMPANY

GENERAL OFFICE: SCHENECTADY, N. Y.

BRANCH OFFICES:

Atlanta, Ga.	Denver, Colo.	Memphis, Tenn.	Richmond, Va.
Baltimore, Md.	Des Moines, Iowa	Milwaukee, Wis.	Rochester, N. Y.
Birmingham, Ala.	Duluth, Minn.	Minneapolis, Minn.	Salt Lake City, Utah
Boston, Mass.	Elmira, N. Y.	Nashville, Tenn.	San Francisco, Cal.
Buffalo, N. Y.	Erie, Pa.	New Haven, Conn.	St. Louis, Mo.
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Charlotte, N. C.	Indianapolis, Ind.	Niagara Falls, N. Y.	Spokane, Wash.
Chattanooga, Tenn.	Jacksonville, Fla.	Omaha, Neb.	Springfield, Mass.
Chicago, Ill.	Joplin, Mo.	Philadelphia, Pa.	Syracuse, N. Y.
Cincinnati, Ohio	Kansas City, Mo.	Pittsburgh, Pa.	Toledo, Ohio
Cleveland, Ohio	Knoxville, Tenn.	Portland, Ore.	Washington, D. C.
Columbus, Ohio	Los Angeles, Cal.	Providence, R. I.	Youngstown, Ohio.
Dayton, Ohio	Louisville, Ky.		

For Michigan business refer to General Electric Co. of Michigan, Detroit, Mich.

For Texas and Oklahoma business refer to Southwest General Electric Co. (formerly Hobson Electric Co.)—Dallas, El Paso, Houston and Oklahoma City.

For Canadian business refer to Canadian General Electric Company, Ltd., Toronto, Ont.

Manufacturers of Complete Electrical Power Plant Equipments and Supplies



The General Electric Company's monogram trade mark is known all over the world. It is the Guarantee of Excellence on Goods Electrical.

GENERATING APPARATUS

The Curtis turbine is built in all sizes from the smallest exciter set to the 45,000 Kw. size—the largest in the world. They are suitable for condensing or non-condensing service, and are also furnished in low pressure or exhaust steam, and mixed pressure types. The latter can be used with high or low pressure steam or both. Steam extraction turbines are furnished where exhaust steam is needed for heating or manufacturing purposes. Engine driven generators are regularly furnished in capacities ranging from 5 to 1,000 Kw. direct current and from 100 to 5,000 Kw. alternating current. Water wheel driven generators have been built in all desired sizes and voltages up to 18,000 KV-A. at 13,200 volts. The General Electric Company has had more experience than any other company in building high voltage generators. These machines do not deteriorate in their windings and are very conservative in temperature ratings.

SYNCHRONOUS CONVERTERS—MOTOR GENERATORS

Synchronous converters and motor-generator sets provide an economical method for changing electric power of any standard frequency and voltage from alternating to direct current or vice versa.

SWITCHBOARDS

For all ordinary requirements the necessary panels can be selected from the G-E catalogs of Standard Unit Panels, and combined into a switchboard that will satisfy every requirement of the installation. The advantages of this method are convenience in ordering, prompt shipment and low price, the latter two resulting from the elimination of engineering and drafting on the individual order.

For high voltage plants and other cases where unusual requirements must be met, special switchboards are designed to meet any conditions of control.

Switchboard specialists are located at many of the principal offices of the company and will furnish data which will enable the engineer to specify a complete switchboard especially adapted to his particular requirements and with all parts built, assembled and tested as a unit by one company.

INSTRUMENTS—METERS

Switchboard and testing instruments and all kinds of electric meters cover fully the requirements for measurement of power.

REGULATORS

Automatic regulators are furnished for keeping the voltages constant on alternating or direct current power and lighting circuits.

GENERAL ELECTRIC COMPANY

TRANSFORMERS

Type H distributing transformers have unusually high factors of safety to ensure reliable service under the severest operating conditions, such as sleet, snow, lightning, overload, etc. The General Electric Company has standardized and carries in stock complete lines of these transformers in capacities 200 KV-A and less for potentials 6,600, 10,000, 13,200 and 33,000 volts.

G-E power transformers are built in sizes up to 15,000 KV-A and are operating very successfully on potentials as high as 150,000 volts. These transformers have superior features which ensure unusual ruggedness when operating under modern transmission conditions of high power and high potential where the strains due to abnormal current, voltage and frequency are unusually severe.

LIGHTNING-ARRESTERS

For alternating current circuits the aluminum arrester is recommended as giving the best protection attainable for station equipment.

For distributing transformers, the graded shunt resistance multiplex or the compression chamber multiplex arrester may be used. The former is sensitive over a wide range of lightning frequencies and should be installed for protection of the larger transformers. The compression chamber arrester, lower priced and slightly less efficient, should be used to protect all the smaller transformers.

For direct current circuits two types of magnetic blowout arresters are available. Where a very high degree of protection is desired, aluminum arresters should be used.

WIRE AND CABLE

The General Electric Company manufactures wires and cables insulated with paper, varnished cambric, rubber or composite (graded) insulation. To meet different conditions of service these cables are furnished with protective coverings of cotton, asbestos, lead, band steel or wire armor.

LAMPS, INCANDESCENT AND ARC

Standard lighting units ranging from a 10 watt EDISON MAZDA lamp to the flame arc lamp for lighting large areas are carried in stock. Lighting specialists and illuminating engineers of the General Electric Company will assist in laying out any lighting system.

WIRING DEVICES

G-E reliable wiring devices include panel boards, fuses, switches, terminals, insulators, etc. All these devices are N. E. C. standard.

MOTORS AND CONTROLLERS

ALTERNATING CURRENT MOTORS for 110, 220, 440 and 2,200 volts at all standard frequencies; constant or variable speed; for continuous or intermittent duty; hand or automatic control.

DIRECT CURRENT MOTORS for 115, 230, and 550 volts; slow or moderate speed; belt, chain, gear or direct drive. Constant, variable, or adjustable speed for continuous or intermittent duty. Suitable control for any service.

All motors are insulated for long life. Specially insulated motors for service in acid or alkaline vapors, excessive alkaline dust, or temperatures as high as 150° C. can be furnished.

The General Electric Company has a motor for every power application, large or small, a controller for every motor, and a specialist who can assist in the combined application to obtain the most satisfactory and economical results.

FLOW METERS

The General Electric Company has developed a practical device for measuring the flow of steam in pipes. The G-E steam flow meter can be installed in any sized pipe at a small expense, and will give reliable readings of the flow. They are specially useful in the boiler plant and turbine room for measuring the output of the individual boiler and the input of the turbines. G-E flow meters are also furnished for measuring the flow of water, air and natural gas.

BULLETINS—FURTHER INFORMATION

Only a few of the products of the General Electric Company are described above. Bulletins, giving information, illustrations and full data on complete electrical apparatus for the power house will be mailed on application from our nearest office.



5280

CROCKER-WHEELER COMPANY

AMPERE, N. J.

Manufacturers of Electric Motors, Generators and Transformers



A. C. AND D. C. GENERATORS

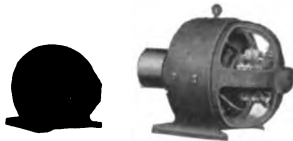
In All Sizes

C-W generators are known among engineers for the special care and attention given to every detail of their design and construction. Simplicity, strength and durability are their distinguishing features.

INDUCTION MOTORS

25 and 60 Cycle—All Sizes

One of the special features of these machines is the superior insulation of the stator windings. This is rendered possible through the use of form-wound coils that are thoroughly insulated and shaped to fit the open slots in the stator. Magnetic slot-bridges are used to bridge the stator slots after the windings are in place. The power factors and efficiencies are as high as consistent with good construction and thorough insulation.



D. C. MOTORS OF ALL SIZES

1/20 to 225 H. P.

These motors are a C-W specialty. They are designed to withstand hard service and abuse. Exceptionally well-insulated windings and large bearings are employed. Special attention has been given to each detail of their design.

They are made for standard voltages in slow or moderate speed types for belt, chain, gear or direct drive.



SPECIAL ROLLING MILL MOTORS

Fire-proof insulation is used and all parts are made extra strong and heavy to withstand the shocks, jars and overloads incident to rolling-mill service. The C-W Company has made a specialty of this class of motors, and can promptly supply motors for any branch of Rolling Mill Service.



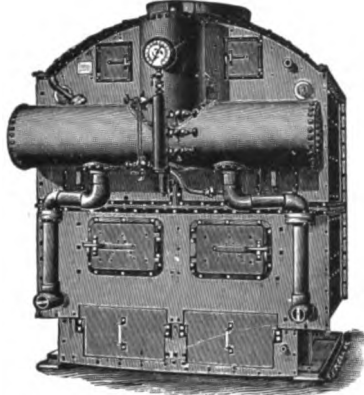
Write for bulletins.

ALMY WATER TUBE BOILER CO.

PROVIDENCE, R. I.

Sectional Water Tube Boilers for Every Marine Purpose

ALMY PATENT SECTIONAL WATER TUBE BOILERS



Exterior—Class B, C, D

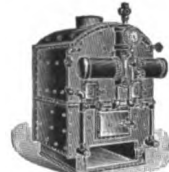
The Almy Boiler is in every respect a Pipe Boiler being constructed of Extra Strong Iron Pipe and Malleable Iron Fittings. As the threads are standard size, repairs may be made conveniently in almost any part of the world. Due to design, expansion and contraction is entirely taken care of and sudden change of temperature has no bad effect on the heating surface. 75 lbs. to 100 lbs. of steam may be raised from cold water within seven minutes with perfect safety.

33



Interior
Class A, B, C

We build six classes or types of boilers—A, B, C, D, E and Z. Type is determined according to the desired duty. Sizes run from 2.7 to 56 sq. ft. of grate surface and 87 to 2,000 sq. ft. of heating surface.



Exterior
Class A

An evaporation of 11.92 lbs. of water from and at 212° per pound of combustible has been shown on a 45 H. P. boiler—rate of combustion 14 lbs. per square foot of grate surface per hour. The same boiler under forced draft evaporated 7.89 lbs. of water per pound of coal—gauge pressure 153 lbs., feed temperature 56°, rate of combustion 35.98 lbs. of coal per square foot of grate surface per hour.

The large amount of fire-box heating surface receiving direct heat is an important feature. In our Class D and E boilers, there is 90% more of such heating surface than in a flat-sided fire box of equal dimensions.

These boilers are very satisfactory with oil burners as quite a number of installations on the Pacific Coast have proved.

Our business is principally marine but we occasionally furnish boilers for stationary use. "Knocked down" boilers may be shipped in 400 lb. packages and under.

Catalogue containing full description of construction will be sent on application.



THE BABCOCK & WILCOX CO.

GENERAL OFFICES:

85 LIBERTY STREET, NEW YORK

BOSTON, 35 Federal St.
PHILADELPHIA, North American Bldg.
PITTSBURGH, Farmers Deposit Bank Bldg.
CLEVELAND, New Guardian Bldg.
CINCINNATI, Traction Bldg.
ATLANTA, Candler Bldg.
NEW ORLEANS, 533 Baronne St.
HOUSTON, TEX., Southern Pacific Bldg.
TUCSON, ARIZ., Santa Rita Hotel Bldg.

CHICAGO, Marquette Bldg.
DENVER, 435 Seventeenth St.
SALT LAKE CITY, 705-6 Kearns Bldg.
SEATTLE, Mutual Life Bldg.
SAN FRANCISCO, Sheldon Bldg.
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SAN JUAN, PORTO RICO, Royal Bank Bldg.

WATER TUBE STEAM BOILERS

Babcock & Wilcox

Stirling

Babcock & Wilcox Marine

Rust

STEAM SUPERHEATERS

MECHANICAL STOKERS

Boiler practice has changed materially in the past ten years. Higher pressures and higher superheat have come into every-day practice and with these changes have also come larger units and higher rates of combustion, due to better stokers and furnace arrangement, better methods of feed water treatment, improved coal- and ash-handling apparatus and a better understanding of the care and operation of boilers. During this period great improvements have been made in the utilization of other fuels than coal. These developments have brought about a change in boiler room design and necessitate a much more careful study of the size of plant, service conditions, fuel, water, and class of boiler room help available.

By reason of the different factors involved the selection of a proper boiler unit is much more complex than in the past. Years ago this Company manufactured a line of so-called "standard" boilers; while these standards are still in existence, the sale of a standard boiler today is a rarity, for the reason that operating conditions cannot be even approximately standardized. Each and every prospective boiler sale is approached by this Company as an entirely new and independent engineering problem, the various factors involved determining the particular type, size and setting of boiler offered.

A very brief description of the different types of boilers manufactured by this Company is given on the following pages.

THE BABCOCK & WILCOX CO.

THE BABCOCK & WILCOX BOILER

The heating surface of the boiler is made up of drums extending longitudinally over the other pressure parts. To the drums there are connected, through forged-steel cross boxes at either end, the sections made up of headers and tubes. At the lower end of the sections there is a mud drum extending entirely across the boiler and connected to all of the sections. The connections between all parts are made by short lengths of tubes expanded into bored seats.

The headers into which the tubes are expanded are of forged steel and are of serpentine or sinuous form so that the tubes are disposed in a staggered position when assembled as a complete boiler. This staggering of the tubes breaks up the gases and causes them to impinge on every tube.

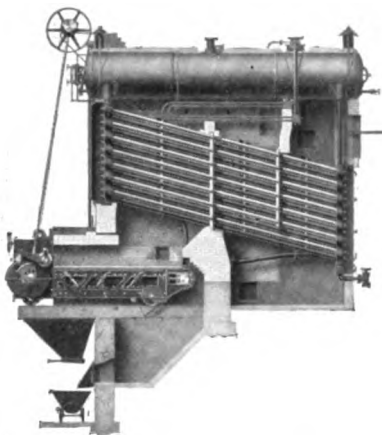
Opposite each tube end in the headers there is placed a handhole of sufficient size to permit the inspection, cleaning or renewal of a tube. These handholes are closed by suitable handhole fittings.

The gases of combustion are caused to make three passes over the heating surfaces by baffles constructed of special baffle brick and cast-iron flame plates.

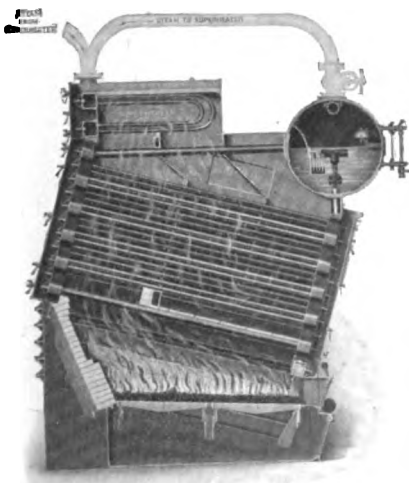
The form of the furnace is such that it is readily adaptable to the fuel available, whether solid, liquid or gaseous.

Boilers are suspended front and rear from wrought-steel supporting frames, entirely independent of the brickwork.

Patented dusting doors furnish a means of keeping all portions of the heating surfaces free from soot and dust. Large doors in the sides of the setting gives full access to all parts for inspection and for the removal of any accumulation of soot.



THE BABCOCK & WILCOX MARINE BOILER



The Marine Type of Babcock & Wilcox boiler preserves the excellent features of the Land Type but adapts them to the conditions on shipboard. The tubes are usually of smaller diameter and are shorter than in the Land Type. The furnace increases in volume toward its exit and with its tile roof gives highly efficient combustion. The flame plates or baffles and the staggering of the tubes give the heating surface an efficiency unobtainable in any other boiler.

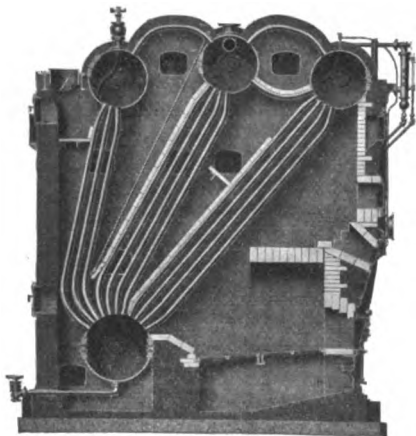
All parts subject to pressure are made of the highest quality of forged steel. No castings are used. The parts are as thick or thicker than the corresponding parts in cylindrical or Scotch boilers. The weight of the boiler, however, is less than one-half that of Scotch marine boilers for pressures above 200 pounds. There are Babcock & Wilcox marine boilers which have been in service for more than fifteen years which are still using the original tubes.

The Babcock & Wilcox marine boiler is especially adapted to the use of oil fuel. Where oil is burned, practically the entire surface of the furnace is composed of fire-brick, insuring perfect combustion.

(Continued on next pages)

(Continued from preceding pages)

THE BABCOCK & WILCOX CO.



THE STIRLING BOILER

The Stirling boiler consists of three transverse steam and water drums set parallel and connected to a mud drum by three banks of water tubes so curved as to enter the drums radially. The steam space of the center drum, from which steam is taken, is connected to the front and rear drum by steam circulating tubes and to the front drum by water circulating tubes.

The tubes are so spaced as to allow the removal of any tube without disturbing any other tube or the brickwork.

The furnace is formed by the use of a firebrick arch sprung across the boiler setting in the triangular space formed by the front wall and the front bank of tubes. This furnace readily lends itself to the installation of any stoker and the burning of any class of fuel.

The gases of combustion are led from the furnace over the heating surface by two baffles of firebrick tile, one resting on the rear row of tubes of the front bank and the other supported on the rear row of tubes of the second bank.

The boiler is supported on a wrought-iron framework entirely independent of the brickwork setting.

Large cleaning doors in the sides of the setting give ready access to all portions for cleaning, inspection and repair.

THE RUST BOILER

The Rust boiler is made up of two transverse steam and water drums and two transverse mud drums connected by banks of tubes. Each steam drum is connected to the mud drum directly below it by five rows of straight tubes and one row of curved tubes. The steam drums are connected by curved steam and water circulating tubes and the mud drums by water circulating tubes.

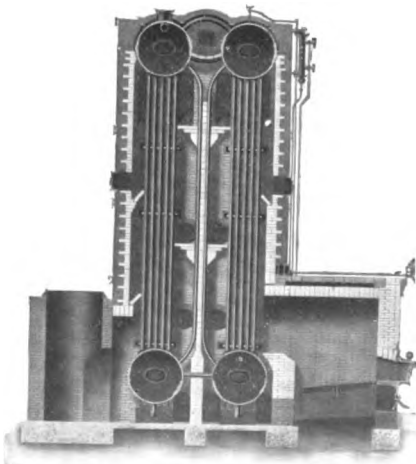
The tube sheets of all drums are pressed to form individual tube seats, thus permitting straight tubes to be expanded directly into the cylindrical drums. This construction is patented.

The tubes are staggered and are so arranged that any tube may be removed without disturbing any other tube or the boiler brickwork.

The furnace is of the extension or Dutch oven type and being distinct from the boiler setting proper, enables any type of furnace or any fuel to be used.

The gases are caused to make two passes over the heating surface by a vertical firebrick baffle built between and held in position by the central curved tubes. Horizontal baffle shelves cause all portions of the heating surface to be swept by the gases.

The boiler is supported entirely free of the brickwork on cast-iron saddles under the mud drums, the saddles resting on masonry foundations.



THE BABCOCK & WILCOX CO.

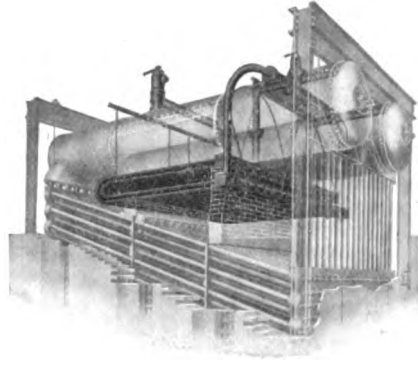
THE BABCOCK & WILCOX STEAM SUPERHEATER

The Babcock & Wilcox superheaters, as built for installation in all boilers of The Babcock & Wilcox Co.'s manufacture, are similar in design, location and operation. The construction is modified in certain details to meet the specific requirements of individual boilers.

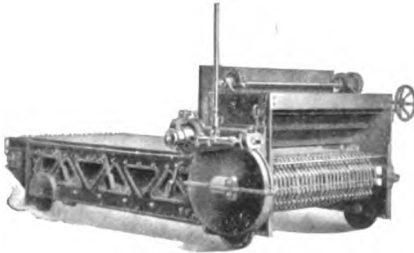
The superheater consists of two headers or manifolds, into which tubes bent to a U-shape are expanded. These headers are equipped with handholes and forged-steel handhole fittings, giving access to each tube end. As there is no rigid connection between the headers and because of the proper methods of suspension, there can be no strains set up in the apparatus by contraction or expansion. Each superheater is equipped with an independent steel-bodied, outside-spring, safety valve.

The superheater in all cases is located in the direct path of the products of combustion. The surfaces presented to these gases are smooth, offer the minimum resistance to the passage of the gases and the least opportunity for the adhesion of dust.

Steam is taken from the steam space of the boiler through the dry pipe, is introduced into the intake header and passes through the superheater tubes to the outlet header, to which the superheated steam connection from the boiler is made.



THE BABCOCK & WILCOX CHAIN GRATE STOKER



The Babcock & Wilcox chain grate stoker consists of a grate in the form of an endless chain passing at the front and rear of the boiler furnace over sprockets which are keyed to shafts carried by the stoker frame. The passage of the grate through the furnace is continuous. The stoker is driven through a worm wheel keyed to the front sprocket shaft. The fuel is fed uniformly to the front end of the grate under an adjustable stoker gate. The volatile gases are driven off on the forward portion of the grate under an ignition arch and are completely consumed in passing over the incandescent fuel bed before striking the boiler heating

surface. Combustion is truly progressive. The ash and refuse are discharged automatically and continuously as the grate turns over the rear sprockets.

The form of the grate links is such as to allow proper admission of air for combustion. Suitable side seals and a bridge wall water box prevent the admission of large quantities of excess air. The bridge wall water box is connected into the water circulation of the boiler and is part of the regular stoker equipment.

The construction of the entire stoker is of such rugged character throughout as to permit continuous operation without the necessity of shut-downs for repair.

This stoker will only be offered for installation where fuel suitable for chain grate stokers is available.

Over 19,000,000 horse power of boilers manufactured by The Babcock & Wilcox Co. are in use throughout the world.

The Babcock & Wilcox Co. publishes the following books: "Steam," "Marine Steam," "The Stirling Water Tube Boiler," "The Rust Water Tube Boiler," "Steam Superheaters," and "Chain Grate Stokers," any of which may be obtained upon application to the nearest of the Company's branch offices.



BADENHAUSEN CO.

1429 CHESTNUT ST., PHILADELPHIA, PA.

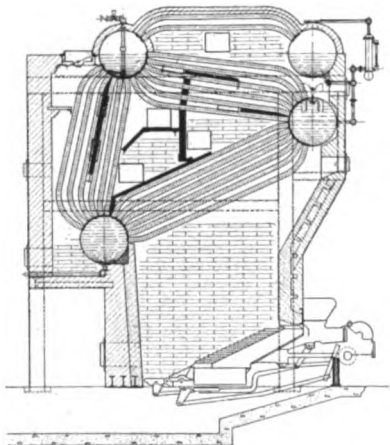
NEW YORK

PITTSBURGH

CLEVELAND

SAN FRANCISCO

LOS ANGELES

Manufacturers of All Steel Water Tube Boilers**BADENHAUSEN
WATER TUBE BOILERS**

of the four-drum type, consist of two water drums and two steam drums. The two water drums and the rear steam and water drum are connected by means of tubes, so as to form a perfect cycle of circulation for the water. The steam drum is connected through the water column opening to the lower front drum.

As the areas of the tubes entering the drums and leaving the drums are practically the same, there is **POSITIVE, CONTINUOUS, UNRESTRICTED CIRCULATION**. Here the **BADENHAUSEN** Boiler excels all other types on the market as the whole life of any water tube boiler must be in the water circulation.

ADDITIONAL POINTS OF SUPERIORITY

Safety: All drums of our boiler are designed and built according to the boiler laws of the State of Massachusetts or the State of Ohio. As may be readily noted there are no contracted areas, headers, water legs, handhole gaskets, handhole openings, etc., and their absence eliminates most factors which lead to boiler explosions. The flexibility of the boiler is such that all variations of temperature are promptly taken care of.

Ease of Cleaning: The **BADENHAUSEN** Boiler is easily cleaned internally by removing four manhole covers and inserting a turbine cleaner into the tube. The outside of the tubes is cleaned by inserting steam lances from the boiler front.

Simplicity of Erection: The boiler is supported by heavy steel framing. This framing consists of I-beams in which case the rear steam and water drum rests upon the horizontal I-beams. The water drum is suspended from heavy turned bolts secured to these I-beams, and the mud drum is suspended from the tubes which are connected to the rear steam and front water drums.

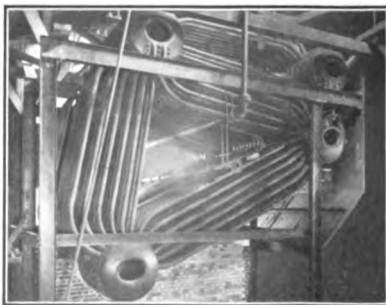
Facility of Repairs: Repairs are facilitated by the tubes being spaced alternately wide and narrow, permitting the replacing of any tube without disturbing any other tube. No baffles will be disturbed.

Ability to Withstand Severe Service: Owing to the perfect circulation of the **BADENHAUSEN** Boiler, it will be found that these boilers need less shutting down for internal cleaning than any other boiler on the market.

Dry Steam: The steam, while passing through the steam tubes, is dried and superheated. This is a feature which few boilers possess.

Baffling: No special baffles needed, standard tile only is used. Baffles easily replaced. Gases must pass all of the tube heating surface.

Size: Can be built in all sizes up to 5000 H. P. So far the largest size in operation is 2500 H. P.

**Method of Supporting Larger Boilers**

THE BASS FOUNDRY & MACHINE CO.

ESTABLISHED 1853

FORT WAYNE, IND.

Manufacturers of Engines, Boilers, Heaters, Steel Plate Work, Rope Wheel Drives, Forgings, Car Wheels and Castings

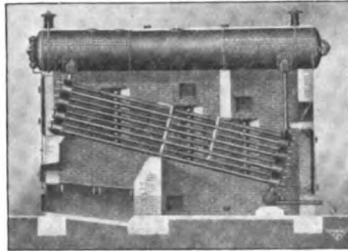
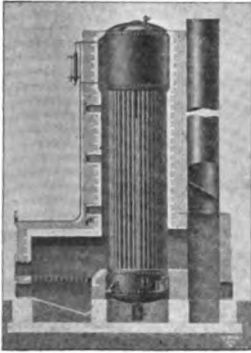


HEAVY DUTY AND GIRDER FRAME CORLISS ENGINES

for

Factory, Rolling Mill and Direct
Connected Service

Built in simple, tandem compound and cross compound types.



HORIZONTAL AND VERTICAL WATER TUBE BOILERS

In sizes from 50 to 1000 H. P.

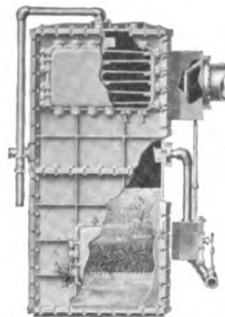


HORIZONTAL TUBULAR BOILERS

SEND FOR A COPY OF

"STEAM POWER"

Which illustrates the different
types of Engines, Boilers, Heaters
and other power plant equipment
which we manufacture.



OPEN FEED WATER HEATERS

Both Horizontal and
Vertical

Either cast iron or steel
construction.

Built in all sizes.

THE BIGELOW COMPANY

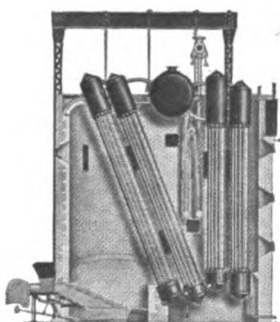
WORKS AND MAIN OFFICE

76 RIVER ST., NEW HAVEN, CONN.

NEW YORK OFFICE, 85 LIBERTY ST.

BOSTON OFFICE, 141 MILK ST.

Manufacturers of Fire Tube and Water Tube Steam Boilers, Digesters, Crystallizers, Vulcanizers, and Heavy Plate Steel Work



Bigelow-Hornsbly Boiler

THE BIGELOW-HORNSBLY WATER TUBE BOILER

Features of the Bigelow-Hornsbly Boiler that meet the requirements of Modern Power House Practice:

1. Unlimited size of units.
2. Small ground space occupied.
3. Coldest water meets the coldest gases.
4. Direct heating surface about four times as great as the average water tube boiler.
5. All parts, both external and internal, readily accessible.
6. All boiler tubes perfectly straight.
7. Circulation of water and liberation of steam unrestricted.
8. Very dry steam, also ample room for superheaters where required.
9. High continuous economy due to extreme cleanliness of the most efficient heating surface.
10. Arrangement of baffling is unique, causing the gases to pass over the heating surface in thin streams and uniformly at every point.
11. Furnace arrangement is ideal for securing perfect combustion, as furnace is correctly shaped and of ample size.
12. Greatest flexibility, both as to construction and in steaming qualities.
13. No cast iron used in any portion of the boiler proper.
14. Constructed both as to workmanship and material in accordance with the most advanced boiler practice.

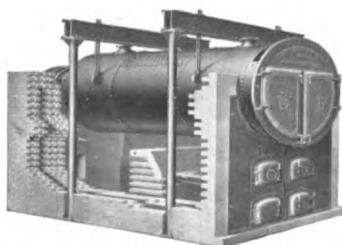


Bigelow-Manning

THE BIGELOW-MANNING BOILER

This type of boiler can be constructed suitable for 200 pounds working pressure or more, in units up to 500 H. P. The shell sheets being away from contact with the fire permits the use of any thickness of shell necessary for high pressures. Another feature conducive to safe operation is the firm support of the boiler, which is accomplished in the Bigelow-Manning type by having a firm foundation upon which the cast iron base rests, without relying upon the support of setting walls.

The economical evaporative performance of the Bigelow-Manning Boiler is remarkable. All radiant heat from the fuel bed is absorbed directly by water-heating surface, the distribution of the furnace gases over the heating surface is practically uniform, the superheat furnished is varied by changing the water level, there are no losses due to the infiltration of air in the setting and stand-by losses are comparatively small, occupying per H. P. much less ground space than other types.



Suspension Type of H. R. T.

HORIZONTAL RETURN TUBULAR BOILER

The advantages of compactness and efficiency, large direct heating surface, easy cleaning, large liberating surface, perfect circulation and minimum liability and ease of repairs are well-known features of this type.

Our boilers are constructed in the most approved manner; we adopt the very highest type of professional and mechanical service, maintain the highest possible standard of efficiency, and believe our facilities for boiler construction are without a parallel.



EDGE MOOR IRON COMPANY

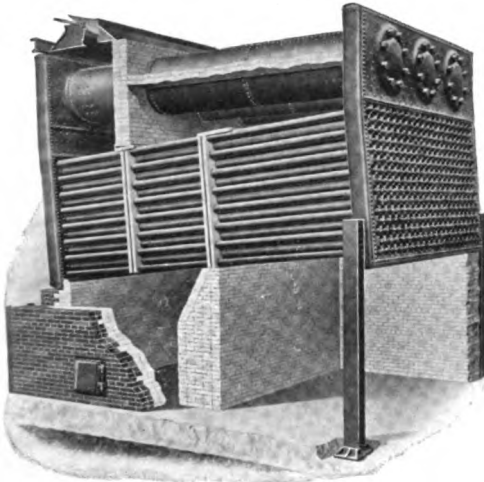
EDGE MOOR, DELAWARE

NEW YORK
111 Broadway

BOSTON
79 Milk Street

CHICAGO
10 S. La Salle Street

Manufacturers of Edge Moor Water Tube Boilers



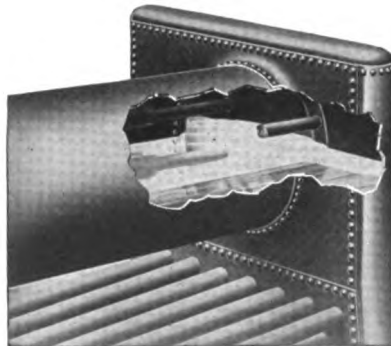
Note the special header construction, the horizontal drums, the elliptical handholes, the steel supports, and the efficient manner of baffling

When a boiler is desired for the exacting service of a modern power plant, the square feet of heating surface and the strength of parts are not the only important factors to be considered. While a boiler appears to be a simple piece of apparatus structurally, its internal performance is far more complex than is generally realized, and it is this complex action that warrants more attention to the details of design.

41

The special features of the Edge Moor boiler cannot be explained in the limited space of an advertisement. Those interested in steam boilers and in tests of unusual performance should send for our illustrated bulletins. They will also do well to ask for preliminary information from one of our sales offices before preparing the final specifications for a proposed plant, for by doing so, they will obtain valuable suggestions without any obligation.

Edge Moor boilers are built in sizes from 100 to 1000 horse-power.



The header construction provides such an increased steam-liberating area that boilers can be safely and efficiently forced to several times rated capacity



Write our nearest office.

THE CASEY-HEDGES CO.

Founded 1889

CHATTANOOGA, TENN.

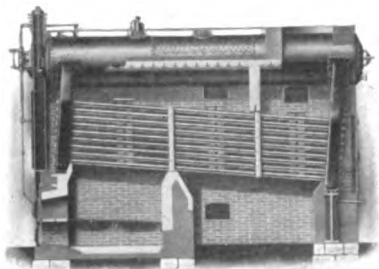
CHICAGO
MEMPHIS
DALLAS

NEW ORLEANS
SEATTLE
HAVANA, CUBA

NEW YORK
BIRMINGHAM
SAN JUAN, P. R.

Manufacturers of All Types of Boilers and Plate Metal Work

Boilers built in accordance with A. S. M. E. Code when desired.



**C-H Horizontal Water Tube Boiler,
Vertical Baffle**

C-H HORIZONTAL WATER TUBE BOILERS

All steel construction. Built in units from 75 to 1000 H. P. Oval handholes with machined surfaces. With either Horizontal, Vertical or Combination Baffles. Large areas through water legs permitting rapid circulation. Boiler supported free from brick work by wrought steel supporting frame at front end; the rear by columns with expansion saddles and rollers.

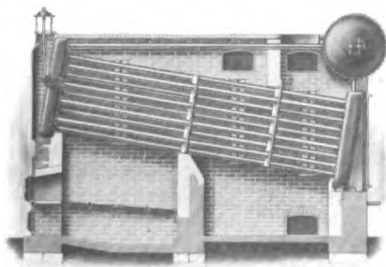
C-H HORIZONTAL WATER TUBE BOILERS WITH STEEL CASED SETTING

This type of setting entirely overcomes the defects of the brick setting, which consist chiefly of air leaks due to expansion and contraction; also reduces maintenance cost and decreases cost of foundations. Steel casings may be applied to either the Horizontal or Vertical Baffle types. The steel casing may also be used in conjunction with stokers.



C-H CROSS DRUM WATER TUBE BOILER

Especially suitable for installations where head room is restricted, such as basements and office buildings. Boiler is of sectional construction; may be shipped knocked down and parts taken through small openings. Built in sizes from 75 to 600 H. P.

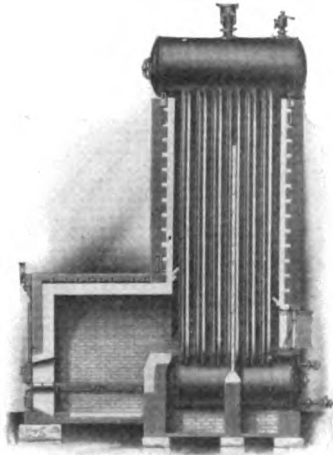


C-H Cross Drum Water Tube Boiler

THE CASEY-HEDGES CO.

C-H VERTICAL WATER TUBE BOILER

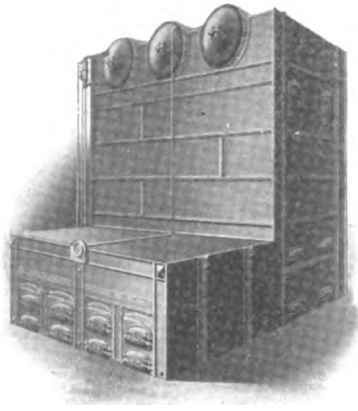
This boiler is of simple construction and very efficient. Consists of one or more upper drums, connected to one or more lower drums by a series of tubes placed in staggered rows. Baffles are set vertically in boiler and may be arranged for either two or three passes of the hot gases through the tube heating surface. Tubes enter drums radially, and are curved to an easy radius. Boiler is of unit construction. Boilers of large capacity being composed of a number of boilers of a smaller capacity. Therefore, the size of boiler is unlimited. Furnace is of Dutch Oven construction.



C-H Vertical Water Tube Boiler

C-H VERTICAL WATER TUBE BOILER WITH STEEL CASING

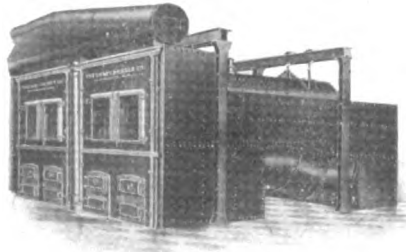
The C-H Vertical Water Tube Boiler is an ideal boiler when steel encased. A special design of steel casing is used, built in sections. Each section is provided with tie bar lintels that hold the wall in place, preventing buckling or bulging inward of the brick work. It is unnecessary to discuss the value of the steel casing, as it is well known.



C-H Vertical Water Tube Boiler with Steel Casing

C-H HORIZONTAL RETURN TUBULAR BOILER WITH STEEL CASING

We originated the steel cased type of boiler setting, and have perfected three well-known types; viz., Standard, Full Dutch Oven and Semi-Dutch Oven. Steel Casing construction of heavy steel and braced with angles. Will save 33⅓% in brick work and 60% in foundations. The steel setting is absolutely air tight; does away with expansion leaks in brick work; has practically no maintenance cost; assembled complete before shipping; may be installed by a novice.



C-H Steel Casing for Tubular Boilers

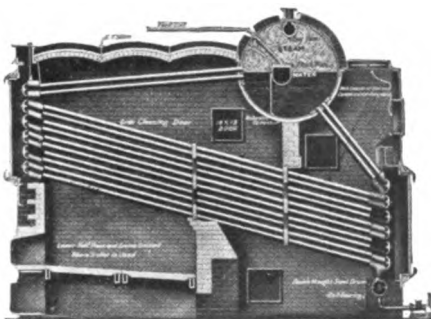
Catalogue of the Casey-Hedges' Products Will Be Furnished on Application.

FLANNER WATER-TUBE BOILER CO.

AKRON, OHIO

THE TAYLOR-PEARSONS MERCANTILE STAFF,
Northeastern Mgrs., 70 FIFTH AVE., N. Y.

THE FLANNER WATER-TUBE BOILER



Cross Sectional Side Elevation

This is the most modern improved type of sectional boiler. Being of the cross drum type it is accepted by the leading engineers as being the most efficient, economical, and durable boiler manufactured. There are NO STAY BOLTS OR BRACES used in the FLANNER Water-Tube Boiler, thereby making it the safest boiler on the market. There are NO BENT OR CROOKED TUBES OR RIGID WATER-LEG construction which means loss of money and sometimes loss of life.

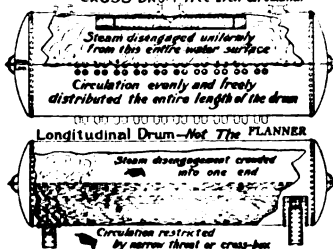
The FLANNER Water-Tube Boiler has the greatest amount of heating surface per square foot of floor space, and takes less head room than any other type of water-tube boiler, which features make it extremely adaptable where space is a consideration. It is built in units from 100 to 2,000 H. P., and is especially adapted for central power stations and all kinds and conditions of work. It can be arranged for any type of Automatic Stokers.

FLANNER DOUBLE CAPACITY FLOWED STEEL HEADERS are hung by pendulum rods and suspended from heavy steel frames, thereby eliminating the stress of contraction and expansion. Illustration shows a header with the tubes rolled in place forming a SECTION. It also shows the inside cap covering four tubes. This method of grouping the tubes in sets of four enables us to use one hand-hole plate for every four tubes. This reduces the openings 75% which materially reduces the cost and increases the ease of cleaning.

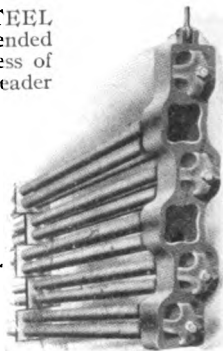
Circulation

This illustration shows the free and easy circulation of the FLANNER Cross Drum Type as compared to a throttled water-leg or any other type where a longitudinal drum is used. In the FLANNER the steam is evenly distributed the entire length of the drum whereas the other types have a choked circulation due to the water-leg construction.

FLANNER CROSS DRUM - Free Even Circulation



The FLANNER Type has FOUR CIRCULATING TUBES entering and delivering dry steam from each header into the steam drum thereby giving twice the steam discharge area of any other design of boiler, which produces better circulation, and does away with any pounding or foaming, as in the longitudinal type, and insures for the Flanner a normal water line under any and all conditions.



E. KEELER COMPANY

Established 1864

WILLIAMSPORT, PA.

NEW YORK BOSTON PHILADELPHIA PITTSBURGH CHICAGO CLEVELAND RICHMOND
SAN FRANCISCO

Manufacturers of Water Tube and Tubular Boilers. Steel Plate Work

KEELER WATER TUBE BOILERS

Standard Type: The arrangement of furnace, tubes, headers and drum in the Keeler Water Tube Boiler is efficient, accessible and compact. The superior efficiency of the Keeler Boiler rests upon correct proportions of heating and grate surface for the character of fuel to be burned, ample height of furnace, a superior arrangement of baffle walls and a perfect circulation. Every portion of the heating surface is accessible for both external and internal inspection, making it impossible for soot or scale to accumulate undetected. There is ample room between tubes and drum for inspection or repairs. Special side cleaning doors make it possible to observe the condition of the outside surface of the tubes. There is no part of the interior surface that cannot be examined and cleaned.

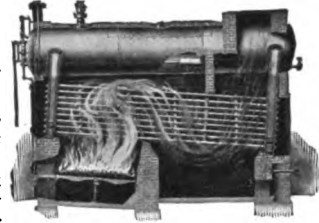
Keeler Water Tube Boilers are usually built complete and tested in the shop. This reduces the cost of erection, as the boilers are handled as a unit. It also eliminates the dangers due to careless assembling of boilers in the field and makes the erection merely a matter of placing in position and attaching fittings.

Built in units 75 to 1500 H. P.

Cross Drum Type: The Keeler Cross Drum Water Tube Boiler is a modification of the standard design, only in the length and location of the drum and the method of connecting it to the headers. This type was developed to meet the demand for a high pressure water tube boiler that could be installed in Office Buildings, School Houses, Churches, Apartment Houses, Hotels and boiler rooms generally where ceiling height is limited or where the boiler must be introduced through narrow passageways or restricted openings.

The pressure parts of the boiler are shipped in a knocked-down condition, making it possible to install it without cutting through walls and floors in locations that would be wholly inaccessible for almost any other type of boiler. If boilers are to be exported, the cross drum boiler can be handled at much less expense by steamship companies on account of its reduced bulk in a knocked-down condition, and the comparatively small weight of the heaviest piece.

Built in units 60 to 600 H. P.



Standard Type Water Tube Boiler



Cross Drum Type Water Tube Boiler

45

KEELER HORIZONTAL RETURN TUBULAR BOILERS

Our Return Tubular Boiler is the product of fifty-two years' experience of boiler building. Tube holes are drilled from the solid plate, and not punched small and reamed to size. All seams are thoroughly caulked on the outside, and the end of butt straps are caulked on the inside. Braces are drop-forged. Steam outlets, man-hole plates, yokes and brackets are of pressed steel.



Horizontal Return Tubular Boiler



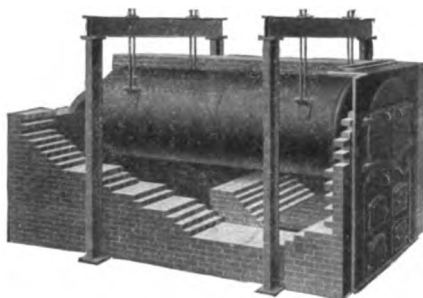
FIFTY-TWO YEARS OF BOILER BUILDING

Ask for Catalogs

THE HOUSTON, STANWOOD & GAMBLE COMPANY

CINCINNATI, OHIO

Manufacturers of Steam Engines and Boilers. Heavy Duty Lathes

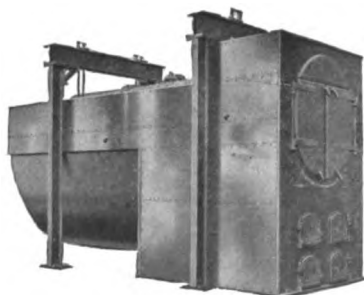


Boiler with Full Flush Front and Suspension Apparatus

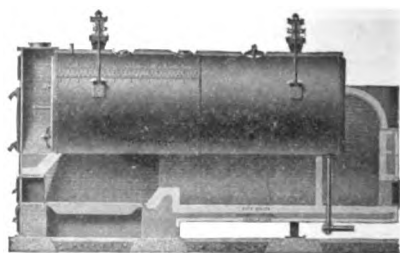
We build all sizes of **Horizontal Tubular Boilers** up to 84" X 20'—250 H. P. The 72", 78" and 84" diam. boilers in the 18' and 20' lengths are the most popular sizes and are also most efficient in respect to first cost per H. P. and operating efficiency. We especially recommend The American Society of Mechanical Engineers' boiler code to prospective purchasers as the boiler specifications contained therein embody good boiler practice.

The **steel casing boiler setting** is a steel jacket for the brick work which secures an improvement in the economical performance of the boiler plant through almost entirely eliminating air leakage through the walls; also greatly reduces the maintenance expense through largely avoiding the necessity of repairs to the brick work, the brick lining being held rigidly in place by the steel jacket. The

style of steel casing illustrated is only one of the many designs of steel casings built by us.



Steel Casing Boiler Setting with Flush Front

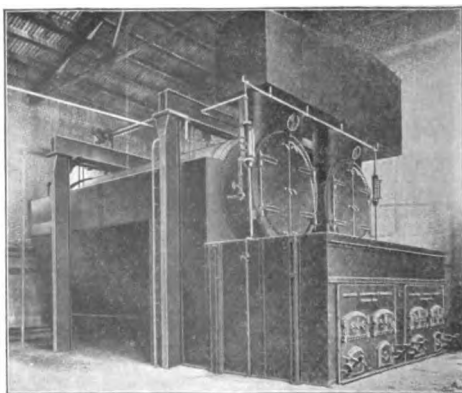


Sectional View Steel Casing Setting

The sectional view shows the relation of the brick lining and the insulating lining, the latter being placed immediately inside the steel plates of the casing. Through the use of insulating lining, such as diatomaceous earth, asbestos or other suitable material, the common brick ordinarily employed are almost entirely dispensed with, thus reducing radiation loss, the space occupied, the total weight and the amount of fuel required for raising steam when starting.

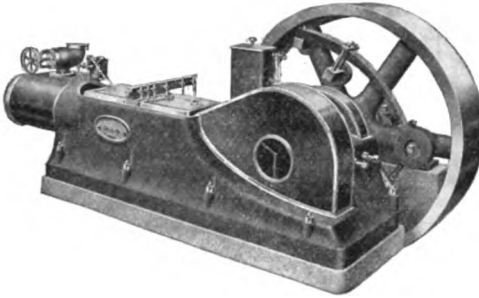
Illustration at right shows a battery of two boilers having steel casing settings. This installation happens to be equipped with dutch ovens for burning low-grade, high-volatile bituminous coal.

We also build locomotive firebox portable boilers, feed water heaters, smoke-stacks, heavy tanks and do a wide range of similar work.

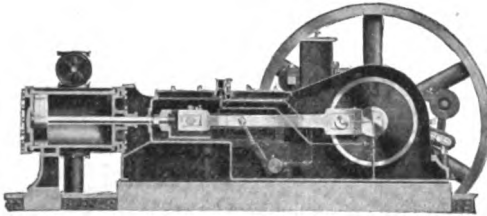


Installation of Two Boilers with Steel Casings

THE HOUSTON, STANWOOD & GAMBLE COMPANY



Completely Enclosed, Automatically Oiling Engine with Shaft Governor



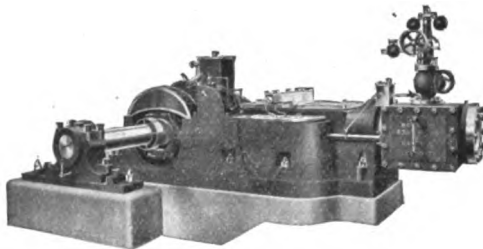
Sectional View

There is a considerable demand for a high-grade completely enclosed automatically oiling engine for direct connection to rotary pumps, fans, blowers, etc. For this class of service it is frequently preferable to operate the engine under control of the throttle or with a limit-speed throttling governor. When this is the case it is often desirable to have a hand adjustment for varying the cut-off (illustrated herewith). We also similarly equip center crank engines when preferred.

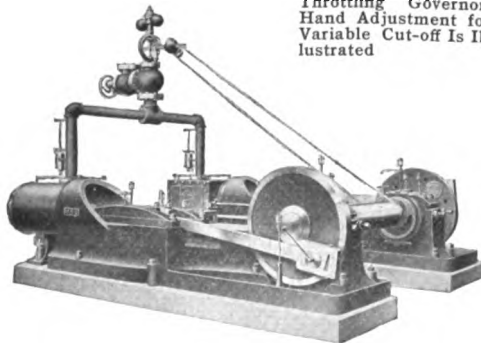
Open type engines of the side crank style are built by us with single cylinder with capacities up to 350 H. P. or with twin cylinders up to 700 H. P. We build open type engines both simple and compound and equipped with either throttling or shaft governors. We build center crank open type engines up to about 100 H. P. The illustration shows a large size twin engine of about 500 I. H. P. Such attachments as link motion, gearing, hoisting drums, etc., are frequently furnished by us.

We build completely enclosed, automatically oiling engines with single cylinder in sizes up to 300 I. H. P. or in twin or cross compound styles, up to proportionately larger ratings. It will be noted that while all of the moving parts are readily accessible, yet even the valve gear is enclosed in such a way as to permit the bearings of the valve gear to be flooded with oil in the same manner as the other bearings are lubricated. Our line of enclosed engines includes the side crank style as illustrated, also includes the center crank style.

The sectional view will make clear our system of lubrication. The lubricating system is so designed that the piping is completely enclosed within the bed plate, so that it does not have to be shipped separately and attached at destination.



Completely Enclosed, Automatically Oiling Engine with Throttling Governor. Hand Adjustment for Variable Cut-off Is Illustrated



Heavy Duty, Open Style Twin Engine with Throttling Governor

THE GEORGE T. LADD CO.

GENERAL OFFICES

1620 FARMERS BANK BUILDING

PITTSBURGH, PA.

Manufacturers of the Milne Water Tube Boiler

MILNE WATER TUBE BOILER

PATENTED—OTHERS PENDING

UNRESTRICTED
CIRCULATION.

STAGGERED
TUBES.

NO HANDHOLE
PLATES.

IMPURITIES
ELIMINATED BY
FEED BOX.

DRY STEAM.

NO STAYED
SURFACES OR
CAST METAL.

HIGHEST
EFFICIENCY.

LOW STACK
TEMPERATURES.

ALL WROUGHT
STEEL
CONSTRUCTION.

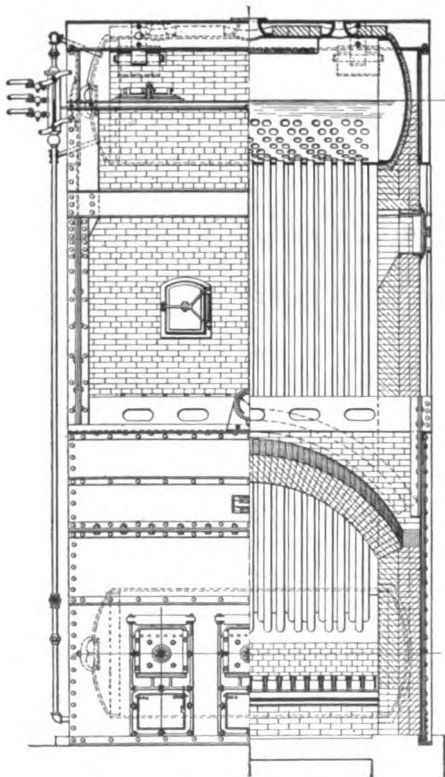
ALL TUBES
BENT TO
SAME RADIUS.

EACH TUBE
EASILY
REMOVABLE.

LARGE
OVERLOAD
CAPACITY.

NO RIVETS OR
SEAMS IN PATH
OF GASES.

ALL JOINTS AND
SEAMS READILY
ACCESSIBLE FOR
EXAMINATION.



Front View

ADAPTABLE TO ALL TYPES, SIZES AND CAPACITIES OF MECHANICAL STOKERS. FOR BURNING OF COAL, COKE BREEZE NATURAL GAS, BLAST FURNACE GAS, WOOD AND BAGASSE. ALL HEATING SURFACES EASILY CLEANED. SUPPORTED FROM SHELL, NO HEAD LUGS USED. BUILT IN ACCORDANCE WITH LATEST RULING OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS. SIZES RANGE FROM 125 TO 1500 H. P. IN TYPE AS ILLUSTRATED AND TO 3000 H. P. IN MULTI-DRUM TYPE.

INVESTIGATE HIGH ARCH TYPE FOR LATEST PRACTICE WITH UNDERFEED STOKERS.

THE GEORGE T. LADD CO.

INSIDE PLANE OF ALL SUPPORT MEMBERS FLUSH WITH FACE OF BRICK—
ABSOLUTELY NO MEMBERS EMBEDDED IN BRICKWORK EITHER SINGLE
OR BATTERY SETTING.

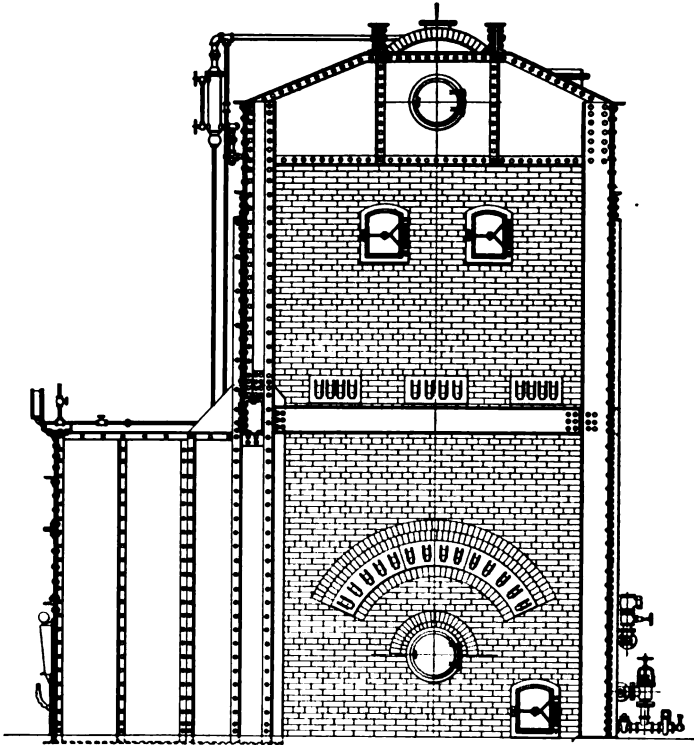
ELIMINATION OF AIR LEAKS.

MAXIMUM LIFE OF SETTING.

LOW COST OF UPKEEP.

AIR-COOLED FRONT WALL SUPPORT.

9" FIRE BRICK LINING THROUGHOUT BOILER. ARCHES 12" ALL WEDGE BRICK.



Side View

NO DUTY ON BRICKWORK EXCEPT THAT OF INSULATION.
SUPPORTING FRAME AND BINDING OF BRICKWORK COMBINED IN ONE
STRUCTURE.

ALL BRICK SHAPES STANDARD.

ALL ARCH THRUSTS PROVIDED FOR IN SUPPORTING STRUCTURE.
STACK CAN BE CARRIED ENTIRELY ON SUPPORTING FRAME WITHOUT AID
FROM BRICKWORK.

MATERIALS AND WORKMANSHIP OF HIGHEST GRADE THROUGHOUT.

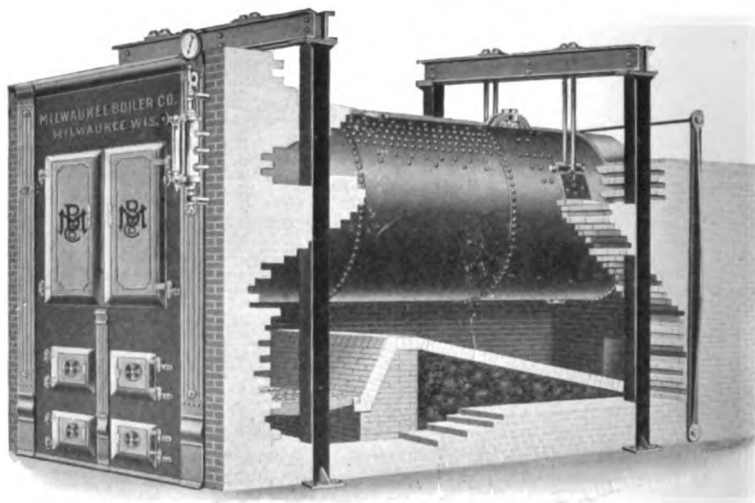
Write for Catalog and List of Prominent Users

MILWAUKEE BOILER COMPANY

220 OREGON ST., MILWAUKEE, WIS.

Boilers, Stacks, Tanks and Steel Plate Work

MILWAUKEE BOILERS



50

Milwaukee high pressure horizontal tubular boiler with full front and suspension setting

We manufacture power boilers designed for working pressures of 100, 125 and 150 pounds. Every detail of construction has been carefully considered and every precaution taken to secure efficiency, safety and durability.

Both during construction and after completion, rigid inspection and test assure that the highest standards are maintained.

STEEL PLATE CONSTRUCTION

We are Prepared to Furnish anything in Steel Plate Construction for Beet Sugar Refineries, Paper Mills, Oil Refineries, Soap Factories, Wood Alcohol and Turpentine Plants, Tanks (for storage or pressure) with Riveted Seams, Penstocks, Riveted Pipe for Hydraulic and Steam Pressure, Exhaust Pipes, Steam Headers, Exhaust Heaters, Brick Hardening Cylinders, Galvanizing Pots, Retorts, Stills, Agitators, Steam Pans and Jacket Kettles.

Our engineering and estimating department is at your disposal to assist you in designing any article required in our line.

We are prepared to quote favorable prices on Rendering Tanks, Self-Supporting Stacks, Riveted Pipe, Gas Purifiers, Water Jackets, Coal Hoppers, and other articles of similar construction.

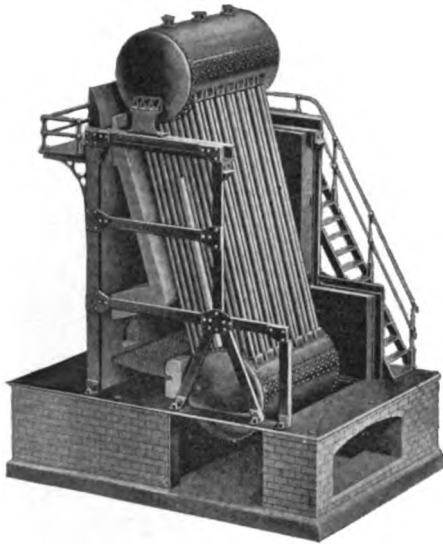
We carry a large stock consisting of plates, sheets, tubes, rivets, bars and flanges. This enables us to make prompt shipment of all orders.

This stock includes castings of all kinds for boiler setting, also a full supply of valves and gauges.

JOHN MOHR & SONS

349-359 W. ILLINOIS ST., CHICAGO, ILL.

Manufacturers of the Garbe Water Tube Boiler, Blast Furnaces, Steel Ladles, Hot Stoves, Cupolas, Furnaces, Mixers, Converters, Sterilizers, Etc.



Garbe Patent Water Tube Boiler

THE GARBE BOILER

Special Advantages

All handholes with their troublesome and expensive gaskets are eliminated, as the tubes are expanded into very large drums which are equipped with the patented pressed "Garbe" Plate. Any tube can easily and quickly be inserted, removed and replaced without disturbing any of the others.

Elimination of all flat surfaces, stay bolts and braces. All parts of Boiler are cylindrical and curved.

All tubes are absolutely straight and nearly vertical, therefore the entire circumference of tube is directly exposed to the gases. The effective heating surface is materially larger than that obtained by horizontal tubes.

The upper drum is suspended from a substantial structural frame work, absolutely independent from the mason work. The lower drum is in contact with two slides or guides, thereby allowing free expansion of tubes, equalizing the strain between drums and reducing chances of leakage to a minimum.

The vertical arrangement of tubes allows the steam to develop very freely and to flow by the shortest way possible without changing direction to the upper drum, thereby causing a very rapid circulation. The tubes are distributed over the full length of the Boiler, thus giving a large and uniform steam-liberating surface, equal to the full area of the tubes. This vertical arrangement of tubes will do away with local overheating and consequent rupture of the tubes so often occurring in horizontally arranged tubes.

Soot, dust and ashes cannot accumulate on tubes or any part of drum, thereby allowing longer periods of operation without the necessity of cleaning.

Large water capacity, due to the extremely large size of upper and lower drum, insuring a more constant water level than any other Boiler.

The feed water passes through the rear bank of tubes, which have the lowest temperature, to the lower drum and deposits therein all impurities.

Over half of the entire heating surface is effective in liberating steam.

Practically no scale in tubes owing to rapid circulation and vertical tubes.

PAGE BOILER COMPANY

GENERAL OFFICES:

815 TO 819 LARRABEE ST., CHICAGO, ILL., U. S. A.

Manufacturers of Page-Burton Water Tube Sectional Steam Boilers

PAGE-BURTON WATER TUBE SECTIONAL STEAM BOILERS

SELF-CONTAINED

Built For Any Space Conditions. Largest Power. Small Space.

Highest Efficiency. Absolutely Safe. Long Life.

The Page-Burton Water Tube Boiler is self-contained. The steel enclosure is lined with air cell asbestos and fire brick. Air leaks are not known in this enclosure.

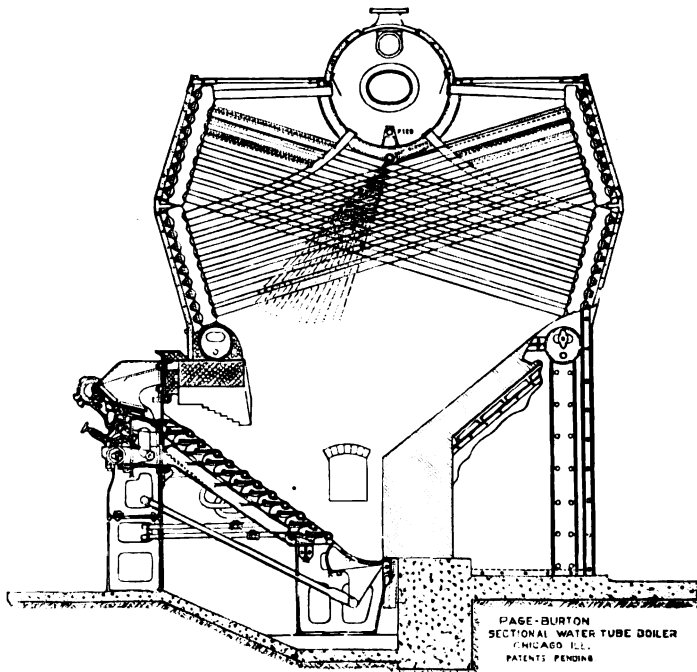
Boilers adapted to any type furnace—due to its sectional design, all material can be delivered into an opening 4 ft. by 4 ft. Largest power, smallest space. No trouble to keep boiler free from sediment inside and soot outside. The Page-Burton Boilers are equipped with our oscillating soot blowers. All sections blown in one minute, not a door to open.

The large mud drums are truly settling chambers and when properly handled the boilers may be washed out as quickly as a tubular type boiler.

Trouble is an unknown factor in the Page-Burton Boiler, built for any pressure desired.

Send for our new catalog. Patents pending.

Note large combustion area directly beneath the entire tube surface, every inch of water heating surface effective, gases are split up vertically and horizontally. Baffles are at top which causes gases to expand as they pass around the steam drum, the best possible efficiency is obtained.



PHOENIX IRON WORKS CO.

Established 1865

MEADVILLE, PA.

Telephone: Bell 3; Meadville 3.

SALES AGENCIES

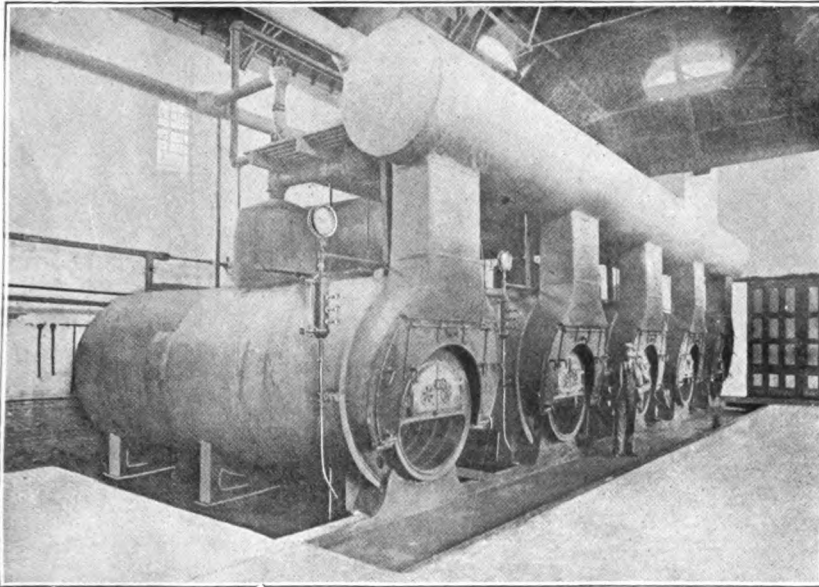
NEW YORK CITY

PHILADELPHIA, PA.

PITTSBURGH, PA.

SAN FRANCISCO, CAL.

Manufacturers of Boilers, Stacks, Breechings, Tanks, Plate Work—Riveted and Welded. Iron Castings and Special Machinery. Engineers and Machinists



53

INTERNAL FURNACE BOILERS

The internal furnace type is a most economical type of boiler. All the liberated gases are brought into direct contact with the heating surfaces and there is no brick work to absorb and radiate a considerable percentage of the heat units. We claim that these boilers built on our specifications will give the highest efficiency of any type of boiler made.

Standard Boiler Type P: We furnish these boilers either with plain or corrugated furnaces, depending on the working pressure and other conditions. Built in sizes up to 150 H. P. and for 150 pounds working pressure.

Dutch Oven Boiler Type Q: Designed for Dutch Oven Setting of the ordinary type, or for furnaces of the Burke or McKenzie type, or similar types, or for forced draft or automatic stokers. Sizes up to 270 H. P.

Oil Burning Boiler Type R: Carefully designed for fuel oil or natural gas, the proportions of which will give the highest efficiency and lowest uptake temperature. Sizes up to 200 H. P.

Inquiries promptly attended to.

SPRINGFIELD BOILER & MFG. CO.

SPRINGFIELD, ILL.

Builders of "Springfield" Boilers

"SPRINGFIELD" WATER TUBE BOILERS

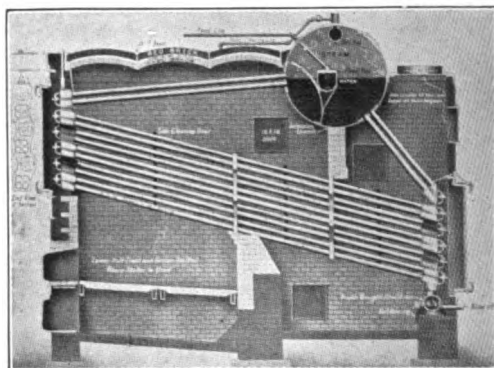
Sectional-Sinuuous Headers

NO Staybolts

NO Braces

NO Bent Tubes

ALL STEEL Construction



Side Elevation

Illustration shows a complete section of the "Springfield" Water Tube Boiler in place, with the front header suspended and the rear resting on a ball bearing. This construction allows the header to come and go from any direction, relieves it from all strain, and does away with the wear and tear that is sure to follow in a boiler where the joints are rigid. The front headers hang from suspension rods. There are no riveted seams where the header is connected to the drum, as in water-leg boilers.

The 3-inch tubes are placed at an angle of 15 degrees. This gives rapid and perfect circulation. They are in groups of four, with one *hand-hole* to each group. Two-thirds less hand-holes than in any other horizontal water tube boilers; this greatly facilitates and lessens cost of cleaning. Hand-holes have *inside plates of drop-forged steel*.

Each section is connected to the steam and water drum by four tubes; this gives very large liberating area, evenly distributed over the entire length of the drum. This insures perfect circulation. Drum of large diameter and special dry pipe insures dry steam.

Baffles are made of cast iron, with open face and cast iron sleeves, through which the tubes pass. They are filled with fire clay and cement, held in place by flame bars, and form a solid wall. They are indestructible. Permit removal of any tube without disturbing other tubes or baffles.

Tubes are staggered in such a way as to allow the gases to completely surround them. This allows a thorough mixture of the gases of combustion.

Boiler is very compact; occupies less space than any other boiler of like capacity and requires less brick for its setting; approximately 97 per cent of the total heating surface is *in the tubes*.

"SPRINGFIELD" INTERNALLY FIRED BOILERS

with Corrugated Furnaces, have many valuable features to recommend them both to the Engineer and to the user. They are rapidly becoming adopted everywhere for both power and heating purposes. *Economical* in the use of fuel, floor space occupied, head-room, repairs, and because they are easy to clean.



Write for pamphlets and further data.



TRADE MARK

HENRY VOGT MACHINE CO.

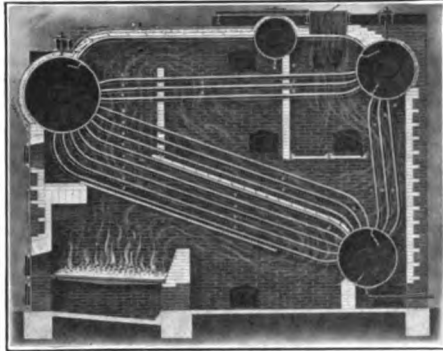
LOUISVILLE, KY., U. S. A.

Manufacturers of Ice and Refrigerating Machines, Water Tube and Other Boilers. Drop Forgings

VOGT WATER TUBE BOILERS

The Vogt Water Tube Boiler is constructed to meet the demand for a strictly safe, durable and efficient steam generator, and is free from many objectionable features commonly found in other types of boilers. Look at the cut for the obvious advantages of Vogt construction:

- Wrought-steel throughout.
- No flat stayed surfaces.
- Accessibility for cleaning and inspection.
- No multitude of hand-hole plates.
- Rapid circulation.
- Complete combustion.
- Dry steam.
- Steadiness of water level.
- Flexibility of construction.

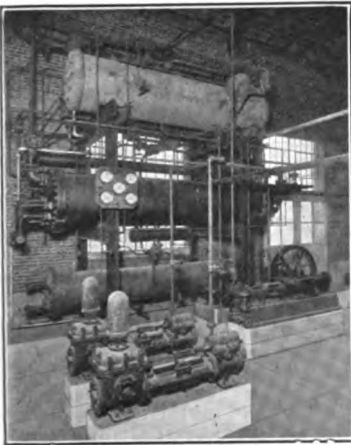


Section Showing Advantages of Vogt Water Tube Boiler Construction

VOGT RETURN TUBULAR BOILERS

The Vogt Return Tubular Boiler is of unusually strong construction, being made of the very best quality of flange or firebox steel, for insuring long wear and withstanding high pressure. The tubes are either lap-welded or seamless steel. The larger sizes have longitudinal seams, triple or quadruple riveted double butt strap joints. All flat surfaces are properly stayed with solid steel stays.

VOGT ICE AND REFRIGERATING MACHINES



Installation Louisville City Hospital
20-Ton Exhaust Steam Refrigerating
Machine

Absorption System

The simple construction of the Vogt refrigerating machine is one of its many superior features.

They are built in sizes from 8 to 300 tons refrigerating capacity, and can be installed as an isolated unit or in connection with any type of power plant where steam is available.

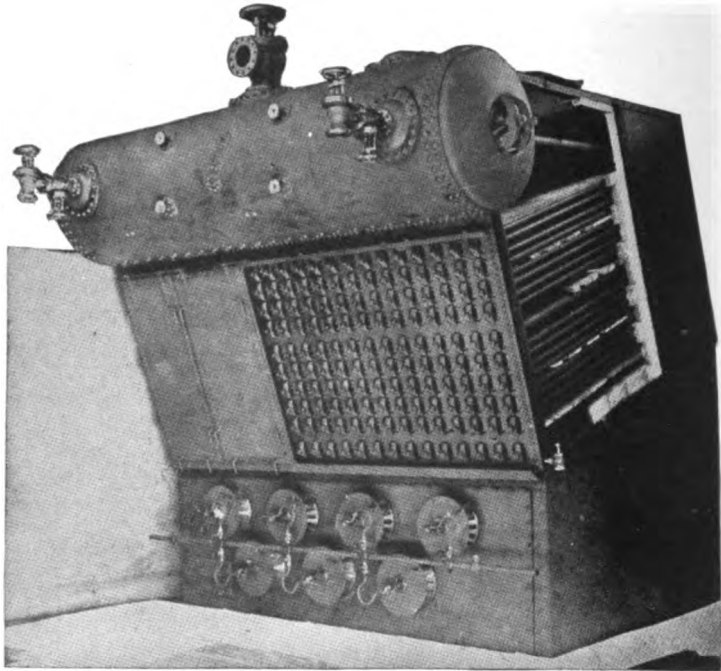
It consists of Generator, Aqua Ammonia Pump (either single, direct acting or fly-wheel type), Absorber, Exchanger, Rectifier, Condenser and Weak Liquor Cooler (either horizontal tubular, atmospheric or double-pipe type, depending upon water temperature and conditions).

Only one running part, the ammonia pump, makes the Vogt Absorption Machine the simplest, most economical and durable.

THE CHARLES WARD ENGINEERING WORKS

CHARLESTON, W. VA.

Manufacturers of Water Tube Boilers and Marine Engines



WARD'S WROUGHT STEEL MARINE BOILER

Improved and Most Rapid Circulation

Generating Tubes Expanded

No Other Joints

No Nipple Connections

No Staybolts

Illustration shows Ward Boilers for U. S. Supply Ship "Bridge,"
4275 Square Feet Heating Surface Each.

Contract Awarded as Result of Evaporative Trials
by United States Naval Board.

16.73 Pounds Water per Pound of Oil

81.68 Per cent Efficiency

Built in 60 standard sizes, ranging from 1700 to 5000 S. F. H. S.

THE WICKES BOILER COMPANY

MAIN OFFICE AND WORKS, SAGINAW, MICH.

Sales Offices in Principal Cities

Manufacturers of Steam Boilers

WICKES VERTICAL WATER TUBE BOILERS AND STEEL CASED BOILER SETTINGS

Water Tube Boilers have proved their efficiency. The need is for very simple water tube boilers. The Wickes Vertical Water Tube Boiler has proven its superiority. **FIRST:** *It is constructed entirely of homogeneous material and uses straight tubes.* **SECOND:** *It operates with high commercial efficiency—the sum of all efficiencies.*

Two 12 x 16-inch manholes open in this boiler—one top—one bottom, inspection and cleaning is a simplified matter. Every tube can be looked through, washed or scraped.

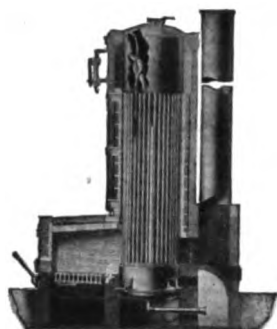
It is easy to clean. If you have ever cleaned a boiler and lamed your back, bruised your knees, and skinned your elbows, you will appreciate the accessible construction of this boiler. Two men can open, turbine and close the Wickes Vertical Water Tube Boiler in ten hours. You know how long it takes to clean some boilers. A clean boiler promotes efficiency. A boiler easy and quick to clean is likely to be cleaned often and well—that is human nature. When your boilers—any of them—stand idle there is a considerable investment upon which you must charge interest that is not earning money—that is not contributing its share to the profit of your Company. On the contrary it is a drag. The overhead and the unit cost of power is low when using this boiler, for it can always be in service.

High furnace temperature results from Dutch oven. Gases entirely surround and closely scrub heating surface from entrance to release. The gases cannot leave the heating surface. There is no possible chance for short-circuiting. The boiler heating surface absorbs the heat—empty pockets in setting lose heat. There are no empty pockets in this boiler. The steel cased settings are always tight, no cracked, warped, leaky, defective and unsightly settings exist with this type. A steel cased setting is a simple and sure cure for air infiltration losses. The largest preventable losses we have to contend with in boiler efficiency are excess air losses. A very long gas travel—hence long contact with heating surface is provided. Heat absorption is, therefore, assured.

Did you ever wreck an engine by pulling water over into it from the boiler? Study this boiler. The steam drum gives great height from water line to steam outlet nozzle. This height provides room for separation of the steam from the water which is entrained with it at a point close to the surface of liberation. Since the shell is subject to a mild degree of heat some superheat is effected on the steam leaving this boiler. You do not pull water over from this boiler.

The concentration of the greatest amount of power per square foot of floor space yet achieved can be attained using this boiler.

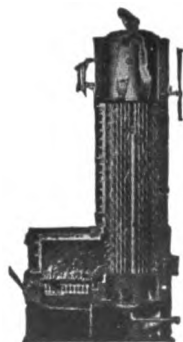
Are you interested in producing boiler horsepower hours per annum cheaply? If so, ask us for particulars.



Cut Shows Position of Man Cleaning. He Stands Erect. Is It Laborious Compared with Usual Forms?



Steel Cased Setting



Quick Steaming, Delivering Dry Steam



THE GREEN FUEL ECONOMIZER CO.

90 WEST ST., NEW YORK, N. Y.

CHICAGO

BOSTON

PITTSBURGH

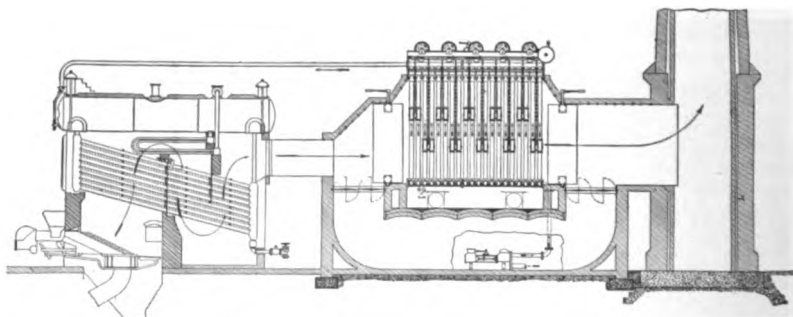
ATLANTA

SAN FRANCISCO

ST. PAUL

Builders of Green's Economizers; Green's Steel Plate Fans; High Efficiency, High Speed, Radial Flow Fans; Mechanical Draft Installations

GREEN'S ECONOMIZER



Typical Installation of Green's Economizer

58

Green's Fuel Economizer is the countercurrent or multi-stage principle applied to steam generation. The boiler is required for absorbing from the gases of combustion the heat required for vaporization, and to provide for the separation of the steam from the water, but the boiler surface should not extend beyond the point where the heat absorbed per square foot is worth less than the annual charges and upkeep upon that square foot. To extend the boiler surface beyond this point is wasteful, since it will not repay fixed charges, and if an economizer is used the boiler can to advantage be terminated before this point.

The Economizer, however, absorbs heat economically from flue gases at temperatures down to 300° F., primarily because it contains water at a temperature lower than that of the boiler contents, giving a greater "temperature head" than in the case of the boiler surface, also because it costs less, square foot for square foot, and is subject to a lower annual percentage for upkeep and depreciation than is the boiler surface.

As ordinarily installed, the Economizer reduces the flue gas temperatures from 600° F. to 300° F., saving 1% of fuel for each 20° reduction in the flue gas temperature. The Economizer pays from 40% to 100% interest upon the investment annually, depending upon operating conditions.

The following is a rough rule for determining the size: Allow about 5 sq. ft. of economizer heating surface per rated boiler H. P.

9' Tube has 12.75 sq. ft. Heating Surface.

10' Tube has 13.96 sq. ft. Heating Surface.

11' Tube has 15.17 sq. ft. Heating Surface.

12' Tube has 16.38 sq. ft. Heating Surface.

For further details and information consult nearest office.

MONONGAHELA TUBE CO.

PITTSBURGH, PA.

**Manufacturers of Iron and Steel Boiler Tubes, Oil Well Tubing and Casing,
Line Pipe, Etc.**

KNOBBLED CHARCOAL IRON BOILER TUBES

SOFT STEEL BOILER TUBES

Made to American Society of Mechanical Engineers Specifications

All sizes from 1½" to 6" diameter both inclusive.

Particular attention is called to a very important change in the meaning of the thickness of gauge as called for in the boiler tube specifications of The American Society of Mechanical Engineers. The trade custom heretofore in vogue has been that the gauge of the tube meant its average thickness, with an allowance of a variation of one gauge above or one gauge below the one specified. The A. S. M. E. specification, however, states that hereafter all tubes intended for boilers that are to be built according to the A. S. M. E. Boiler Code *must not be less in their thinnest portion than the gauge specified.*

For tubes for locomotive and marine boilers, the old specifications of the Master Mechanics and the American Society for Testing Materials are still in force. It is therefore necessary, when ordering boiler tubes, that the customer state whether they are intended for stationary boilers according to the A. S. M. E. specifications, or whether they are intended for locomotive or marine boilers and their respective specifications.

Tube List No. 6, dated February, 1916, sent on request.

59

GENUINE WROUGHT IRON LINE PIPE

OIL WELL TUBING AND CASING

All Monongahela Pipe and Tubes are manufactured from highest quality material and by the Lap Weld process only under most improved methods.

We carry large stocks for quick shipments.

We make all sizes of Line Pipe 1½" to 8" both inclusive, Oil Well Tubing 1½" to 4" both inclusive and casing 3¼" to 8¼" both inclusive.

Price on Wrought Line Iron Pipe, Oil Well Tubing and Casing sent on request.

Also Sole Manufacturers of

"ARMCO" (AMERICAN INGOT) IRON

BOILER TUBES, LAP WELD PIPE AND MERCHANT CASING

In "Armco" goods we make all sizes of Boiler Tubes and Pipe 1½" to 8" both inclusive, and Merchant Casing all sizes 2¼" to 8¼" both inclusive.

List of "Armco" American Ingot Iron Boiler Tubes, Pipe and Casing, can be had on request.

"Armco" Iron Resists Rust.

GLASGOW IRON COMPANY

POTTSTOWN, PENNA.

PHILADELPHIA
603 Harrison Bldg.
15th & Market Sts.

NEW YORK
D. F. COONEY & Co.
88 Washington St.

BOSTON
HARRINGTON, ROBINSON & Co.
Sargent Bldg.

Manufacturers of All Grades of Iron and Steel Plates

FLANGED and DISHED BOILER HEADS.

Flanged Manholes—Handholes and Flueholes.

ROE STAMPED STEEL MANHEAD and YOKE.

Standard and Heavy Threaded Pipe Flanges.

Companion Flanges—Off-Center Pipe Flanges.

MANHOLE SADDLES.

BUCKLED PLATES.

ROE BOILER LUGS.

Rectangular Flanged Heads.

**WELDING AND CUTTING with the OXY-ACETYLENE
TORCH.**



Many shapes formerly made in expensive Bronze Castings can now be made from Steel Plate by Press Work in combination with AUTOGENOUS WELDING.

Pressed Steel HOT BLAST VALVES and VALVE SEATS, Patented.

BOSH COOLING PLATES—TUYERE COOLERS.

FORMING, CUTTING OUT, PUNCHING and BENDING Plate to order.

Bending and Forming ANGLES and SHAPES.

The GLASGOW FLAT FLANGES for Rivetted Pipe.

Pressed from Steel Plate—For Any Service.



Made PLAIN or
BORED, FACED,
HUB BEVELLED,
DRILLED, to order.
Any thickness of plate.
6 ins. to 72 ins. INSIDE
DIAMETER.

These FLANGES, made with a wide flange, make an Excellent Expansion Joint for Pipe Lines.

Correspondence Solicited.

LUKENS IRON & STEEL COMPANY

COATESVILLE, PA.

PHILADELPHIA
Commercial Trust Bldg.

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Continental Trust Bldg.

NEW ORLEANS
634 South Peters St.

CLEVELAND
Rockefeller Bldg.

CHICAGO
1300 N. Branch St.

LOS ANGELES
Citizens Nat. Bank Bldg.

SAN FRANCISCO
Monadnock Bldg.

Cable Address: Lukens, Coatesville, Pa.

Codes—A B C—5th Edition, Western Union

LUKENS

FIRST TO MAKE BOILER PLATES IN AMERICA

One Hundred Years' Experience

The Leader for Boilers and Fireboxes of All Types.

All our plates leveled by special straightening rolls.

STEEL PLATES

THE LARGEST MILL IN THE WORLD

We are building a 204" Plate Mill which will be running early 1917.

We will be able to furnish plates 192" wide.

Siemens-Martin O. H., Basic or Acid Steel.

Tank, Boiler, Ordinary Firebox, Locomotive Firebox and Special Specification Steel.

UNIVERSAL PLATES

8" wide up to 48" wide, inclusive, $\frac{1}{4}$ " thick and heavier.

FLANGING

Machine-Flanged Boiler Heads, Flanged and Dished Boiler Heads, Flue Holes of any diameter.

We can furnish irregular flanged heads or would be glad to quote on any special flanging as we are especially equipped to take care of same.

"BEST YET" MANHOLE FITTINGS

Our New Patented Manhole Cover Plate has no through riveted bolts. Meets all requirements of Steamboat Inspection Rules.

HUSTON PATENT BOILER BRACE

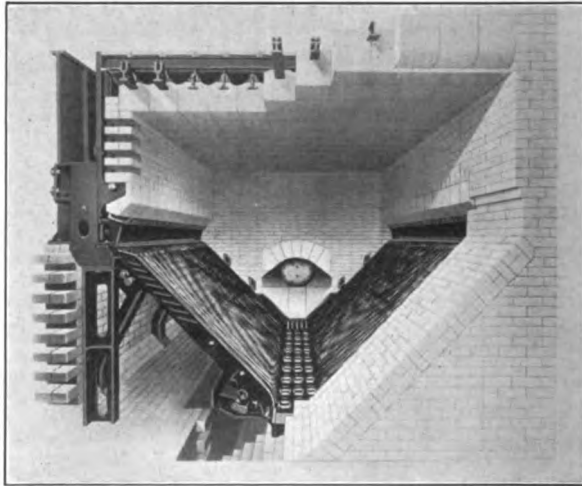
Superior in quality, strength, lightness in weight, workmanship, general appearance and finish.

Send us your inquiries, stating just what you want, and get immediate replies.

DETROIT STOKER COMPANY

DETROIT, MICH.

THE DETROIT "V" TYPE STOKER WITH THE DETRICK FLAT SUSPENDED ARCH



Rear View of Detroit Stoker, Showing the Detrick Flat Suspended Arch

The Arch is cooled by air admitted through openings in the front of the Stoker and being preheated passes into the furnace under control, through the tuyeres over the coking coal and supplies the oxygen for combustion.

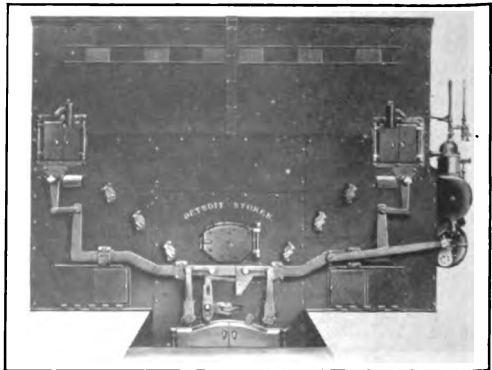
Each tile of the Arch is independently suspended from the center allowing free expansion and contraction and can be easily replaced without disturbing the Arch or brickwork.

This Arch insures high furnace and boiler efficiency and capacity as the gases of combustion are distributed evenly across the entire width of the boiler.

Coal is continuously fed from the Coal Magazines to the upper ends of the Grates. Each alternate Grate has a slicing motion which prevents clinker from forming on the Grates and keeps the entire fuel bed moving towards the Clinker Crusher at the bottom.

The Clinker Crushers have a continuous motion, grinding the clinkers and depositing the refuse in the Ash-pit below.

Adjustments of the Stoker are easily and quickly made to meet any conditions of load or any grades of fuel.



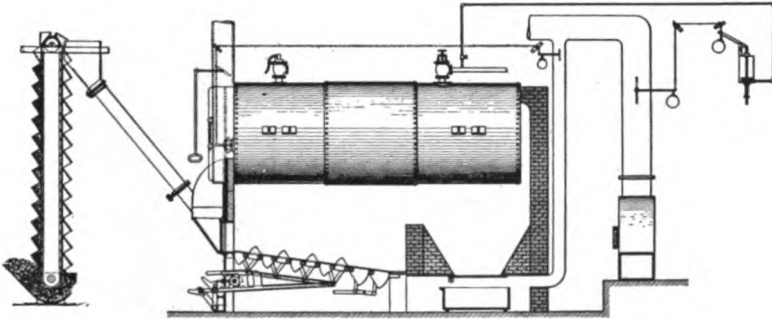
Send for Catalogue D. Address Detroit Stoker Company, Detroit, Mich.

VASIL STEAM SYSTEMS CO.

HUDSON, MASS.

**A Unique Proposition
for Boiler Plants**

**Automatic Stoker
Shaking and Dumping Grate
Smokeless Combustion**



THE VASIL STOKER

This stoker is an assembly of ingenious devices, which are protected by several patents. The system, as shown in the figure, feeds the furnace automatically and maintains a constant leveled fire, regardless of the amount of the coal burned. It saves 15% of coal, and is supplied with artificial draft which enables complete combustion and smokeless stack with any kind of coal. It eliminates 50-75% of labor by means of the conveyors which supply the coal to the grates, and by means of the devices used for the movement of the coal and the emptying of the ashes.

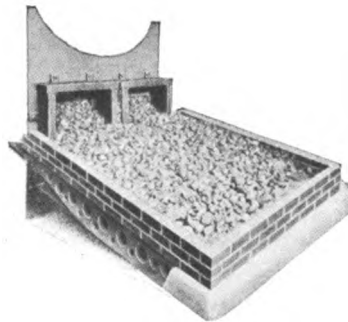
The system can be installed in stationary, marine or locomotive boilers, or in any furnace where coal is burned.

We have already commenced to put the system in the market, and have received orders from the largest concerns.

If interested, we shall gladly send you full particulars.



The grates rise on axis in alternate pairs, forcing the fuel from the front to the rear, where it is deposited on the ash drop.



Note the level distribution of fuel. The fire extends from wall to wall, and front to back, every portion live and active.

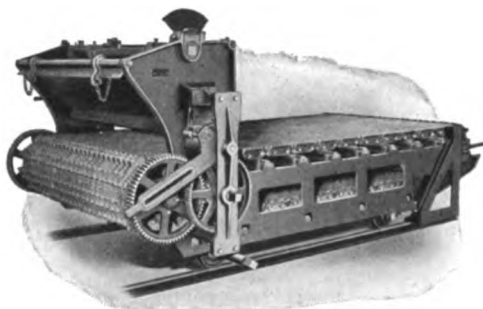
All refuse on the ash drop is dumped by hand, when desired, into a steel pan beneath, which is removed through the ash pit door in front.

GREEN ENGINEERING COMPANY

SHOPS AND MAIN OFFICE: EAST CHICAGO, IND.

Manufacturers of Green Chain Grate Stokers; Geco Flat Ventilated Arches; Geco Pressure Waterbacks; Geco Ratchet Ash Drags; Geco Steam Jet Ash Conveyors

GREEN CHAIN GRATE STOKERS



"K" Type for Free-burning Coals

GREEN CHAIN GRATE STOKERS are designed to produce best results under the conditions peculiar to each installation. Each furnace is given special analysis so that setting best adapted to conditions and requirements is provided.

GREEN CHAIN GRATE STOKERS are designed with all frames and supporting parts away from deteriorating effect of heavy firing, thus allowing, at any time after years of service, replacements at relatively slight cost to obtain the same high efficiency and capacity as with new stokers.

GREEN CHAIN GRATE STOKERS are built in any width from 3 to 14 ft. and in length from 9 to 13 ft. deep. Driving mechanism consists of ratchet cast steel pawls and cast steel spur gear train babbitted in a self-contained frame independent of, but bolted to, the front side frame.

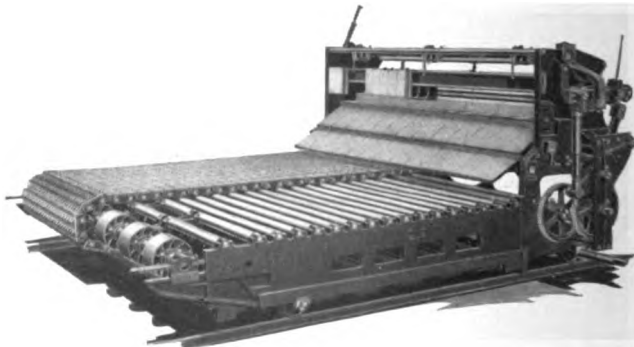
GREEN CHAIN GRATE STOKERS have a feed gate and driving mechanism arranged to permit instantaneous adjustment to meet varying conditions. All parts are ruggedly constructed, well protected, and readily accessible.

"L" Type

for

Coking

Coals



GREEN CHAIN GRATE STOKERS "L" Type provide means for treating coking coals when introduced into the furnace to force their proper ignition and prepare them for complete combustion thereafter. Operation is entirely automatic but simple, effective and flexible through a wide range of capacity.

GREEN CHAIN GRATE STOKERS "L" Type provide the advantage of entirely automatic operation for economical combustion of coking coals with uniform and continuous high economy and high capacity found in no other mechanical stoker.

Geco Flat Ignition Arches permit the use of high ash and lignite coals and give high ignition rates with all coals.

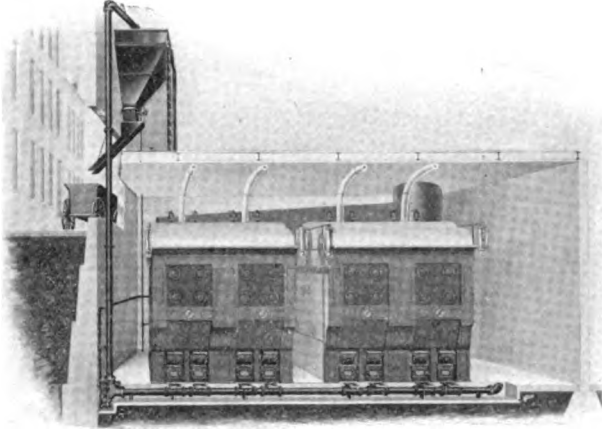
Geco Flat Ignition Arches are adaptable to any width furnace and provide uniform ignition the full width.

Geco Flat Ignition Arches are constructed so that replacements may be easily and quickly made without undue loss of boiler service.

Three Million Horse Power in Service. Write for Bulletin No. 1-A.

GREEN ENGINEERING COMPANY

GECO STEAM JET ASH HANDLING SYSTEMS



GECO Steam Jet Ash Handling Systems consist of GECO Conveyor Pipe located within or in front of ash pits. Inlet openings are provided at each ash pit into which ashes may readily be drawn.

GECO Conveyor Pipe may be connected at any angle, elevation or level between the receiving intakes and the point of discharge, making the system adaptable to any building construction and allowing location of storage where most convenient for disposal to wagons or cars.

GECO Conveyor Pipe has ground joints, requiring no gaskets. Suction is produced by Steam Jets which are placed in elbows where angles in the pipe line occur. Dust, obnoxious gases and fire hazard, the three annoyances heretofore resulting from handling ashes, are all eliminated. Dust and gases are drawn in by the suction at the intakes, and no fire hazard exists as water is sprayed into the conveyor pipe, thoroughly and automatically quenching the ashes during transit and before being discharged to storage.

GECO Steam Jet Systems are reliable and simple to operate requiring only the turning of a steam and a water valve. Ashes drawn to the intakes are instantly conveyed and discharged either in a storage tank, directly into cars, or to ash pile. Storage tank may be either wood, concrete or steel construction.

GECO Metal used in this conveyor is extremely hard and wear-resisting, insuring long life and low maintenance. Provision is made for readily replacing at small cost parts subject to the greatest wear without otherwise disturbing the system.

GECO Steam Jet Systems contain no machinery or moving parts. Their simplicity insures cleanliness, reliability and maximum capacity with minimum power, minimum labor and absolute safety to both workmen and property. No adequate comparison can be made with other methods of handling ashes.

Write for Bulletin 2-A.



MURPHY IRON WORKS

FOUNDED 1878

DETROIT, MICHIGAN

Manufacturers of the Murphy Automatic Smokeless Furnace

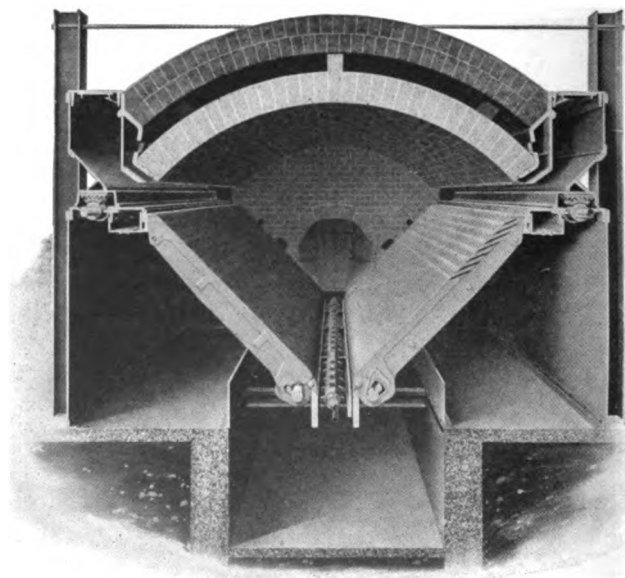
THE MURPHY AUTOMATIC FURNACE is automatic in all its functions. It feeds and distributes the coal and removes the ash and refuse.

It is adaptable to any type of boiler and to units of any size.

It will handle economically all grades of bituminous fuels and is practically smokeless under normal operating conditions.

It is capable of handling variable loads and heavy overloads efficiently and with minimum attention.

The cost of maintenance is low, averaging about 10c. per horsepower per year.



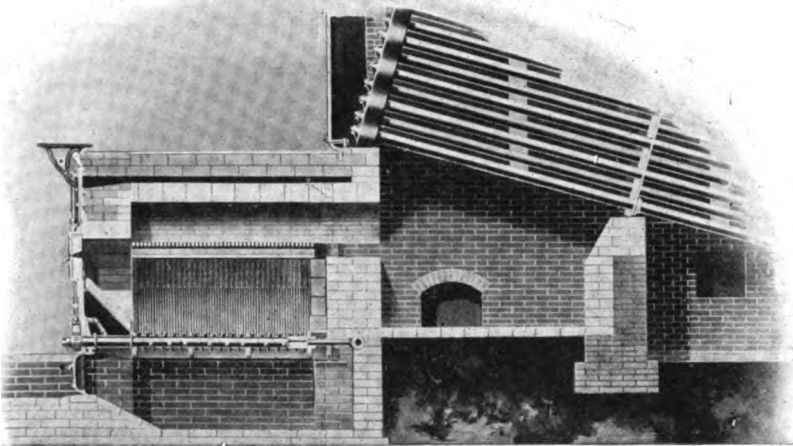
**The Murphy Automatic Smokeless Furnace
REAR VIEW**

The cost of actuation approximates $\frac{3}{4}$ to 1 per cent of total steam generated.

THE MURPHY FURNACE is designed for either NATURAL OR FORCED DRAFT or for combined forced and natural draft. With natural draft the standard sizes of furnaces under proper conditions will operate the boilers up to approximately 200% of their rated capacity—with forced draft to 300% of rating and over.

THE MURPHY HEAVY DUTY FURNACE, for combined natural and forced draft, is an ideal equipment for central stations and plants having heavy overloads and severe peaks. This furnace combines high efficiency and low cost of actuation—obtainable under natural draft conditions—and provides for sudden demands for steam and heavy overloads quickly and efficiently.

MURPHY IRON WORKS



Murphy Furnace—Dutch Oven Setting

At either side of the furnace extending from front to rear is the coal magazine into which the coal may be introduced either by hand or mechanically. At the bottom of this magazine is the coking plate against which the inclined grates rest at their upper ends. The stoker boxes, operated by segment gear shafts and racks, push the coal over the coking plate and on to the grates. The grates are made in pairs, one fixed and the other movable. The stationary grates at their lower ends, rest on the grate bearer, which also acts as a support for the clinker grinder. The clinker grinder consists of a square steel shaft, on to which is slipped small cast iron toothed segments, which are readily replaced in case of breakage.

67

Just over the coking plate is the arch plate, from which a fire brick arch is sprung over the entire furnace. Upon this arch plate are cast numerous ribs to form a series of air ducts immediately over the coking plate, conveying the heated air from the chamber above the arch into the combustion chamber. This arch plate also forms the wall of the magazine. The furnace, or battery of furnaces, can be operated by a small automatic engine, motor or by overhead shaft and ratchet drive, as may be desired. Arrangement is made for exhaust steam connections at the lower end of the grates for the protection of this portion of the grates and clinker grinders and for the softening of the clinker. In connection with horizontal tubular boilers or water tube boilers horizontally baffled, the Murphy furnace can be installed with a flush front setting. Arrangement can be made for extended or Dutch oven settings, should this be desired.



THE AERO PULVERIZER CO.

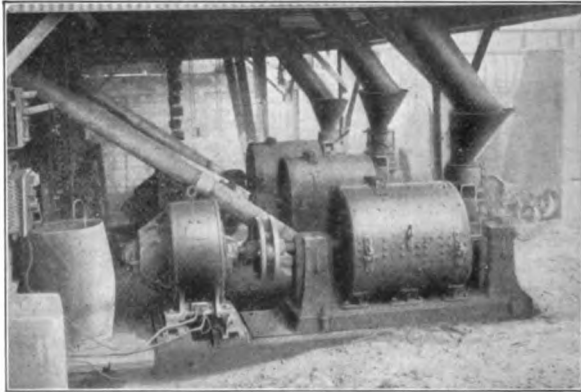
120 BROADWAY, NEW YORK, N. Y.

Cable Address: "Aerorizer"

Telephone: Rector 4215

Room No. 2719

Manufacturers of Pulverizers and Crushers



This cut shows entire equipment for three furnaces, which, with coal bunkers, are on floor above

68

THE AERO PULVERIZED COAL SYSTEM makes the pulverizer and the furnace a unit, with no intervening mechanism,—only a pipe connection. There is no storage of the powder. The coal and air are intimately mixed in the pulverizer and instantly used in the furnace. The operation is under control and easily regulable as to fineness of pulverization, rate of firing, length of flame, character of flame (oxidizing, reducing, neutral) and zone of maximum temperature.

Cost of installation, operation and upkeep is low.

Artificial drying of the coal is merely a furnace and not a pulverizing or storage question where the Aero is used.

The standard sizes are shown in following table, viz.:

Size	Weight in lbs.	Height in inches	Floor Space in inches	Normal ¹ Load Soft Coal lbs. per hr.	R. P. M.	Normal Power Consumption	Horse-power of Motor Recommended
A	2450	28¾	61¾ x 27¾	600	2050	10	15
B	4000	45	77½ x 29	1000	1750	14	25
D	4500	46¾	78½ x 29	1800	1550	25	35
E	5900	50	89 x 33	3000	1450	40	50
G	7200	58	116 x 40	5000	1450	60	80

¹ The load may be increased 25% or decreased 50% without material loss of economy.

CRUSHERS

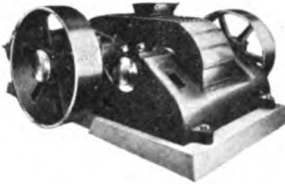
We are the sole manufacturers of the Thompson secondary crusher for ore rock and like material.

Its output is uniform in any size desired from ¾" to 2" mesh. It produces a minimum of dust, the initial investment, cost of upkeep, operation and power consumed are all low. The parts sustaining the greatest wear are of cast manganese steel, and easily and cheaply renewable.

LEHIGH CAR, WHEEL & AXLE WORKS

CATASAUQUA, PENNA., U. S. A.

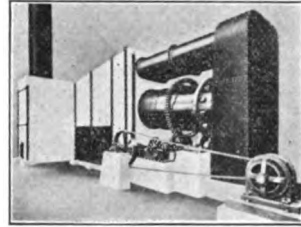
Manufacturers of Pulverized Coal Equipment, Crushers, Dryers, Car Wheels and Axles, Castings, Etc.



Lehigh Crushing Rolls



**Fuller Mill,
Pulley Driven**



Indirect Fired Rotary Dryer

PULVERIZED COAL EQUIPMENT

Design	Superior in Efficiency	Performance
---------------	-----------------------------------	--------------------

We are in position to furnish all the various units used in connection with furnaces heated by means of pulverized coal. At the present time our Pulverized Coal Equipments, consisting of Lehigh Crushing Rolls, Indirect Fired Rotary Dryers, Fuller-Lehigh Pulverizer Mills, Pulverized Coal Feeders, and Fuller Quality Sprocket Wheels, are installed in plants having a capacity of 25,000 tons of pulverized coal per day. These plants are widely distributed and are pulverizing coal obtained from a large number of fields in various coal-producing districts.

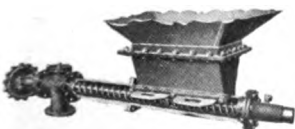
69

The types of furnaces heated with Pulverized Coal are quite diversified, and we enumerate below some of the furnaces at present heated by means of this most economical and efficient fuel in order to convey some idea of the wide application of Pulverized Coal for heating various types of Industrial Furnaces.

Annealing Furnaces
Bar Heating Furnaces
Billet Heating Furnaces
Calcining Furnaces
Drying Furnaces
Forge Furnaces
Nodulizing Furnaces

Open Hearth Furnaces
Ore Roasting Furnaces
Piled Scrap Heating Furnaces
Puddling Furnaces
Rotary Cement Kilns
Rotary Lime Kilns
Steam Boiler Furnaces

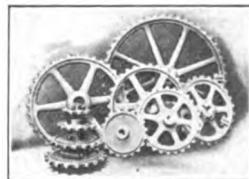
Send for Illustrated Catalogue No. 71.



Pulverized Coal Feeder



**Fuller Mill,
Gear Driven**



Face Hardened Sprocket Wheels

GWYNN GAS BURNER & ENGRG. CO.

Office: 713-714 Empire Bldg. Factory: 100-108 Liberty Ave.
PITTSBURGH, PA.

Gas Burning Equipment Furnished Promptly for Any Kind of Service Where
Natural or Artificial Gas Is Used for Fuel

FUEL EFFICIENCY

This means HEAT—which is our business to supply. If it is a question of NATURAL OR ARTIFICIAL GAS, advise us as to what purpose you wish to apply the same, and we will submit plans and proposition free of charge.

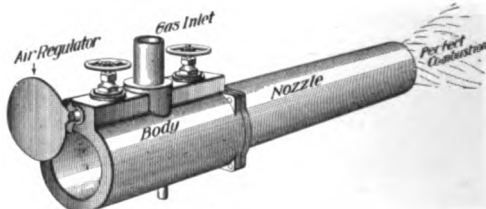


Fig. 1

Fig. 1 shows our Open-Ended Type of Burner, used for all HIGH PRESSURE BOILERS, LARGE HEATING BOILERS, and other work where HIGH POWER BURNERS are required (with either a high or low temperature).

Ask for Catalogue No. 10.

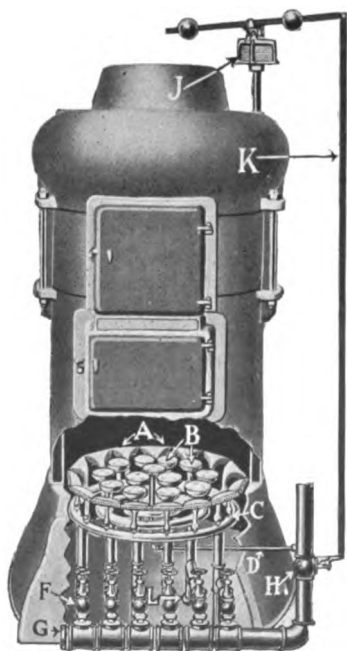


Fig. 2

Fig. 2 shows our Standard Type of Burner, which is used for all DOMESTIC WORK, either with STEAM, HOT WATER, or HOT AIR Furnaces having a round fire pot, and are GUARANTEED to reduce gas bills.

Ask for Catalogue No. 15.

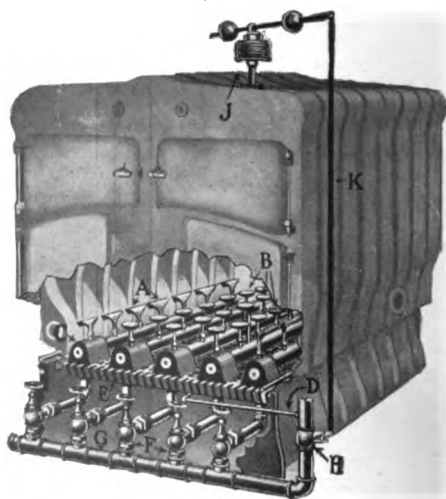


Fig. 3

Fig. 3 shows our Standard Type of Burner for Furnaces having a square or rectangular fire box, either HOT AIR, HOT WATER or STEAM, and can be used with the best results for DOMESTIC WORK or any place where boilers or furnaces of this type are required.

Ask for Catalogue No. 15.

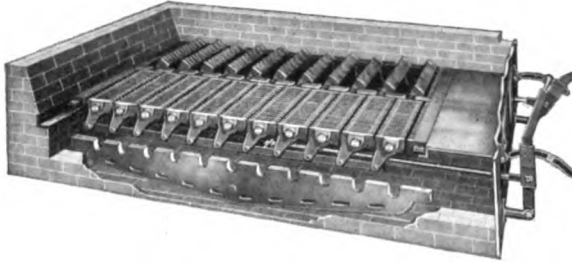
CANTON GRATE COMPANY

1708 WOODLAND AVE., CANTON, OHIO

Manufacturers of Canton Rocking and Dumping Grates, Canton Oil Filters, Feed Water Heaters and Other Steam Appliances

CANTON ROCKING AND DUMPING BOILER GRATES

These boiler furnace grates are made from select brands of pig iron which have been found to give the greatest strength and to resist heat. Their construction is such that they will not warp, as the bars are double braced.



An inspection of the cut will show the simplicity of parts, ease of installation and operation. The grates are strong and durable, and will meet the requirements of heavy mill and other steam power plant work.

IMPORTANT FEATURES

1. A smooth, even surface that will not warp.
2. No complicated parts, but simple in construction.
3. Easily installed in any furnace by any mechanic.
4. New bars can be put in while furnace is in operation.
5. No waste of fuel while shaking.
6. Ease with which it is operated. Lessens labor of firemen, and makes it possible to keep a uniform steam pressure.
7. Our improved safety lever which prevents all possibility of leaving the bars in an uneven position by a careless fireman. It is self-adjusting and practically fool-proof.
8. All parts made heavy and strong enough to sustain without the slightest springing many times the weight they will be called upon to bear and to resist easily any strains that can be brought upon it in the act of loosening clinkers and operating the grate under the full load of fuel.

The Canton Grates are *Efficient Steam Producers*, in most cases saving the price of the Grate in the first few months' use. Made to fit any size furnace and for any kind of coal.

CANTON KILN GRATES

Type "B" Canton Rocking and Dumping Grate is designed to meet the special requirements of kilns for burning fire brick, red brick, paving brick, sewer pipe, drain tile, pottery, fret, etc., any place where high temperatures are required and where heat regulation is an important matter in getting the most uniform result.

They are self-supporting and can be easily changed from one furnace to another. With the self-locking mechanism they are practically fool-proof. Owing to their high efficiency they either effect a large saving of fuel, or greatly increased production with the same amount of coal.



Type "B"

STANDARD SIZES: From 18 inches to 32 inches in width and from 30 inches to 51 inches in depth. We make them any width with any depth desired.

Complete catalog and descriptive literature gladly sent on request.

WASHBURN & GRANGER

50 CHURCH ST., NEW YORK, N. Y.

BOSTON, MASS.

PHILADELPHIA, PA.

Manufacturers of the Dean Dumping Grate, the Dean Shaking Grate, the Dean Furnace, Dean Fire Brick Linings, Incinerators and Destructors, Boiler Fronts and Furnace Castings, Floor Plates, Industrial Railways, Turntables

DEAN DUMPING GRATES



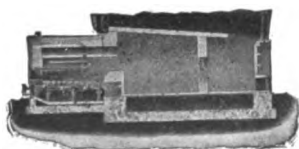
Built for burning the small sizes of Anthracite coal with either natural or forced draft. Bars tip in tandem to an angle of sixty-five degrees and are supported at both ends by a rectangular frame which eliminates entirely the tendency of the bars to hang downward on the ends. Air spaces $\frac{1}{8}$ " to $\frac{3}{8}$ " slot and also built in the pin-hole form with $\frac{1}{4}$ " or $\frac{1}{8}$ " diameter openings. Fires can be cleaned in one-half the time required with stationary bars. Catalogue No. 7 on request.

DEAN SHAKING GRATES



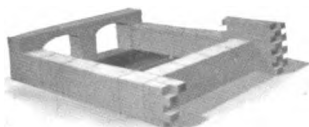
Used for Bituminous and the larger sizes of Anthracite coal, both fuels requiring a grate with an oscillating or shaking movement. Supported by a frame resting on the ash-pit floor independent of the brick work with bars placed on 8" centres, allowing ample opening for the largest clinkers. Journals self-locking requiring no caps. The sides of the bars are made solid which is a necessity as ninety percent of the wear comes along these edges. Construction is of the most durable form, to withstand hard service. Catalogue No. 7 on request.

THE DEAN FURNACE



An efficient hand-fired furnace designed for small and medium size plants and built with large refractory surfaces, has a ventilated arch to admit preheated air over the rear of the furnace and also additional air openings in the side walls of the setting. Built without the use of steam jets to eliminate smoke and provided with twin arches in the combustion chamber and Dean Shaking Grates. Complete booklet describing this furnace in detail will be sent on request.

DEAN FIRE BRICK LININGS



Manufactured to withstand furnace temperatures of thirty-two hundred degrees from Pennsylvania flint and New Jersey plastic clays. Standard side and bridge wall blocks are made 24" long, 18" high and 8" thick with tongue and groove ends and are carried in stock for immediate shipment. The use of a block of this size eliminates the large number of joints required with standard fire brick construction and also the tendency of the furnace walls to burn out. We also build jambs and arches for all types of fire doors. Send for our catalogue No. 5 on "Refractories for Boiler Furnace Linings."

INCINERATORS AND DESTRUCTORS



We have patterns and designs for incinerators for burning rubbish and waste material, suitable for institutions, hotels, schools, apartment houses, museums, factories, etc.

We build garbage destructors of the brick set type suitable for large hospitals and hotels and a portable construction designed with steel casings lined with fire brick, to be operated with either crude oil or gas as fuel. Plans and specifications will be furnished on receipt of full information.

DIAMOND POWER SPECIALTY CO.

DETROIT, MICH.

BRANCH OFFICES:

NEW YORK

CHICAGO

PHILADELPHIA

PITTSBURGH

BOSTON

Export Factory }
WINDSOR, CANADA }

Agencies in All Principal Cities

{ Foreign Branch
LONDON, ENGLAND }

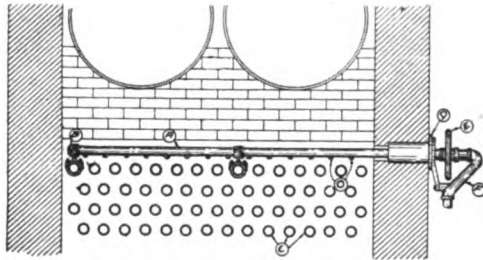
Soot Blowers to Suit Every Type of Boiler

DIAMOND MECHANICAL SOOT BLOWERS

General Description: The DIAMOND MECHANICAL SOOT BLOWER SYSTEM consists of movable automatic units placed at such locations in the passes as will enable them to clean the boiler thoroughly, by means of steam jets. Design and location of the units vary with the type and size of boiler. Revolving units are constructed with either extra heavy steel or INSULINUM pipes. The latter, known technically as "calorized metal," are a product of the General Electric Laboratories, to which Diamond Power Specialty Co. has acquired sole right for use with soot blowers. The great value of INSULINUM lies in the fact that it may be subjected continuously to temperature of 1800 degrees Fahrenheit without deterioration.

The blowers extend across the full width of the boilers. Each unit is supplied with a number of Venturi steel expansion nozzles, which are so distributed that a moving jet of steam is directed between EVERY row of tubes.

For very high temperatures a special automatic unit, which is exclusively a DIAMOND feature, is installed in such a manner as to be secreted within the side wall when not in use.



A—Blower Unit. B—Rear Bearing. C—Boiler Tubes.
D—Front Bearing. E—Operating Wheel. F—Steam Inlet. O—Venturi Nozzles

What They Will Do: Diamond Soot Blowers are guaranteed to keep the heating surface of the boiler on which they are installed free from soot and ash, thus allowing these surfaces to absorb the maximum amount of heat from the gases of combustion as they pass through the boiler. As compared to the antiquated hand-hose method, they will effect a saving in fuel consumption of from four to eleven per cent., and occasionally more.

Durability: Diamond Soot Blowers are built to last indefinitely, if given the same attention any mechanical device is given. Each type of Diamond Soot Blower is specially built and installed to withstand the varied temperatures of the gases existing in those parts of the boiler where the equipment is placed.

DIAMOND SOOT BLOWERS are recognized as the *standard* mechanical soot blowing equipment for all types of water tube and fire tube boilers. They have been on the market for eighteen years, there being today nearly 40,000 in use.

The most commonly used types of Diamond Soot Blowers are described in individual circulars, as follows:

- Diamond Model No. 1, for horizontal and vertical water tube boilers with vertical baffles.
- Diamond Model No. 2, for horizontal water tube boilers with horizontal baffles and hollow stays.
- Diamond Model No. 3, for Wickes vertical boilers
- Diamond Model No. 4, front end soot blower for horizontal return tubular boilers.
- Diamond Model No. 5, rear end soot blower for horizontal return tubular boilers.
- Diamond Model No. 6, for vertical fire tube boilers.
- Diamond Model No. 7, a front end blower for marine boilers.
- Diamond Model No. 8, a rear end blower for marine boilers.

Diamond Mechanical Soot Blowers are also built for the following types of boilers: Rust, Badenhause, Parker, Hornsby, Garvey, Cahall, Maxim, Gun Boat, Scotch Marine, Fire Box, Locomotive, Fitzgibbons, and for Economizers. There are no individual circulars describing these blowers; the Company will furnish prints and a detailed description of them upon request.



TRADE MARK



Inquiries from Engineers and Executives with fuel problems to solve are solicited.

DODGE SALES & ENGINEERING CO.

Distributor of the products of
DODGE MFG. CO., MISHAWAKA, IND.

15 Branch Warehouses in the United States. Dealers in Every Representative City



THE EUREKA WATER SOFTENER

In converting water into steam there is, under the most favorable conditions, a great waste of heat energy. To minimize this loss has been the aim of mechanical men and inventors ever since the adoption of steam as a motive power.

Practically all natural waters are impregnated, to a greater or lesser extent, with soluble metallic salts, which tenaciously attach themselves to the boiler tubes and shell as the water is evaporated into steam, thus forming a cement coating, that not only persistently resists removal, but is also a non-conductor of heat.

Scale $\frac{1}{8}$ inch thick is very common in boilers and appears to be insignificant, yet careful experiments have demonstrated that even such a thin layer of average composition causes a loss of 9% in heating power, which rapidly increases as the layer thickens between cleanings.

Mechanical cleaners are expensive to operate, both as to power and labor required and the more inaccessible parts of the boiler are *never* reached. In many plants a force of men are continually at work drilling out tubes.

Exhaust steam feed water heaters can remove from water only the carbonates (lime), as these are held in solution by carbonic acid gas which is expelled by ordinary boiling at atmospheric pressure, and the carbonates, being thus released, are partially precipitated in the heater. The sulphates, however, which form the hardest kind of scale, are not affected in the heater, and pass on into the boiler where they are precipitated by the high temperatures attained under pressure.

Another expensive phase of the water supply problem is found in many localities where manufacturers are unable to use their own well water owing to its extreme hardness, and are forced to buy a high priced city supply, which, though better than their well water, is far from perfect. The cost of treating such waters is comparatively little, the average water running only about two cents per 1000 gallons for the necessary chemicals.

Practically all water supplies, whether from well, stream or lake, can be reduced to a common uniform degree of softness by the Dodge "Eureka" Automatic Water Softener and Purifier.

The water may be supplied to the inlet tank either by pressure or gravity. A constant head is maintained in this tank, and the weight of the water falling on a wheel, E, furnishes all the power required to actuate the plant.

A portion of this raw water is diverted to a saturator, J, where a clean lime solution of constant strength is manufactured. In our method none of the impurities in the lime come in contact with the water to be treated, thus there are no lime particles to go over into the piping and boilers. The alkalinity of the purified supply is practically nil, so there is not only no danger of foaming in the boilers, but the water is eminently suitable for all kinds of high class work, such as in wool scouring, dyeing, bleaching, etc.

A series of spiral plates, N, accelerate the precipitation of the impurities as the water travels upwards after the chemical reaction has occurred. The sludge deposited on these plates gravitates into the cone from whence it is flushed to the sewer by simply opening the valve S for a few seconds daily.

After leaving the spiral accelerators the water passes through a wood fibre filter, A, into reservoir Y, from which point it is drawn off for use, all scale-forming matter, mud, etc., having been removed.

The machine starts and stops automatically as water is required and will supply any quantity up to the rated capacity. The only attention necessary is about 20 minutes daily, which can be given by the engineer or other employee without interference with his regular duties. It is never necessary for any purpose whatsoever to enter the machine.

Further particulars will be furnished upon application.

WM. B. SCAIFE & SONS CO.

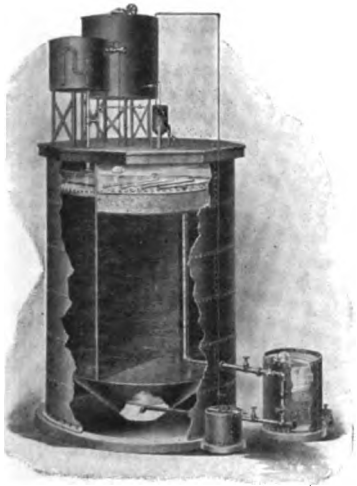
Founded 1802

221 FIRST AVENUE, PITTSBURGH, PA.

Water Purification for All Purposes: Continuous and Intermittent Water Softening and Purifying Systems; Pressure and Gravity Filters and Filtration Systems



We-Fu-Go System (Patented)



Syphon System (Patented)

WATER SOFTENING AND PURIFYING SYSTEMS

The fundamental features of all our designs of systems are—accurate chemical treatment, thorough mixture of reagents with water, accelerated chemical reaction, rapid sedimentation, and perfect clarification. Design for each installation and performance guarantees are based upon scientific investigation of water supply and uses, supplemented by analysis and treatment of water in own laboratory.

We-Fu-Go System—(Intermittent): In this system definite quantities of water are treated, therefore accuracy of treatment can be maintained and uniform water obtained regardless of variations in quality of raw water or rate of use. Consists essentially of two or more reaction and settling tanks, which also act as storage tanks, fitted with mechanical stirring devices operated by power, a small reagent mixing tank, means for introducing the reagents into the reaction tanks, and a quartz filter of either gravity or pressure type. Built for any capacity.

Syphon System—(Continuous): An automatic system not dependent upon moving mechanical devices for reagent introduction. The water enters a receiving tank to which is connected a syphon, into the long leg of which smaller syphons connect from the solution tanks. Reagents introduced during the period of syphon discharge. This system can be arranged to be operated either from the ground or from the top.

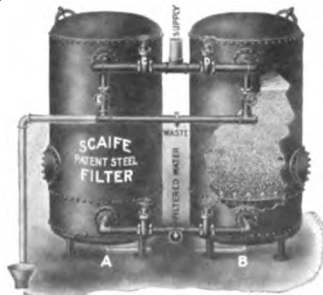
In addition we manufacture three other standard continuous systems and design special systems where required.

PRESSURE AND GRAVITY FILTER SYSTEMS

Pressure Filters are adaptable for every purpose and are built in capacities from 20 gallons per hour upward, to withstand any required pressure. When operated in pairs, each filter is cleaned with filtered water, one filter furnishing the water for cleansing the other.

Gravity Filters are built in units with capacities varying from 8,000 to 1,000,000 gallons per 24 hours each. Combinations for practically any capacity with required sedimentation can be furnished.

Patented brass conical strainers and patented valveless coagulant feed apparatus are special features embodied in these filters and filter systems.



Pressure Filters



HARRISON SAFETY BOILER WORKS

3130 N. 17TH STREET, PHILADELPHIA, PA.

Manufacturers of Cochrane Feed Water Heaters, Steam and Oil Separators, Multiport Valves, Metering Heaters, Sorge-Cochrane Hot Process Softening Systems

THE COCHRANE FINDING CHART

For Finding Equipment Which Will Make Your Steam Plant Most Efficient.



Horizontal Separator

For purifying exhaust steam from engines and pumps, so that it can be used in heating and drying systems, cooking kettles, calendering rolls and low pressure turbines, use Cochrane Oil Separators.

For protecting engines and turbines against water, insuring better lubrication with less oil, and protecting the turbines against erosion of blades, use Cochrane Steam Separators.



Vertical Separator

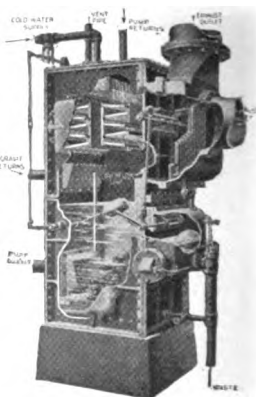
For reducing vibration and pulsation in the steam lines, raising the average pressure in the steam chest, and for getting along with smaller steam lines and fittings, use Cochrane Receiver Separators, which have an ample well, both to receive large doses of water, and to supply steam storage close to the engine throttle.

See our book on "Cochrane Separators, Their Design, Types and Uses."



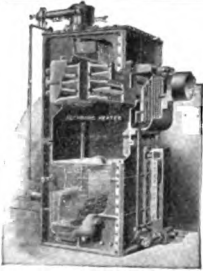
Receiver Separator

For use in connection with exhaust steam heating or drying systems, combining the functions of feed water heater and independent separator for purifying the exhaust steam used in the radiators and coils, install the Cochrane Steam-Stack and Cut-Out Valve Heater and Receiver, which is fitted with a separator large enough to purify all of the exhaust steam in the plant, and with valves by means of which the body of the heater can be cut out of circuit for inspection or cleaning while the separator continues in operation. All about exhaust steam heating systems, with useful tables and data, is given in our "Exhaust Steam Heating Encyclopedia."



Steam Stack Heater

HARRISON SAFETY BOILER WORKS

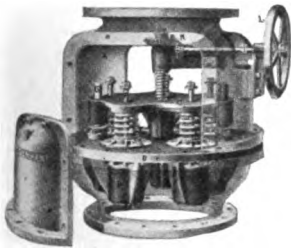


Open Heater

For finding out how many pounds of steam you get from a pound of coal, so that you can determine the best of coal to use, how much it pays to clean scale and soot off tubes, the best methods of firing or draft control, the effects of stopping up air leaks, etc., install the **Cochrane Metering Heater**. It performs all the functions of the standard Cochrane Heater, and, besides, accurately meters the water. See our book, "Finding and Stopping Waste in Modern Boiler Plants."

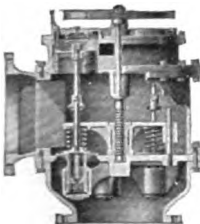
For protecting your exhaust steam system against excessive rise of pressure, that is, for protecting heating or drying systems or

condensers, install the **Cochrane Multiport Valve**. A number of disks instead of one large disk reduce weight and travel, and hence the tendency to hammer, which is eliminated altogether by an effective dash-pot for each disk. There are no moving parts connected to the disk extending outside the casing, hence no possibility of overweighting, tying down or jamming, as by overtightening of packings. See our book on "Multiport Valves, Their Types and Uses."



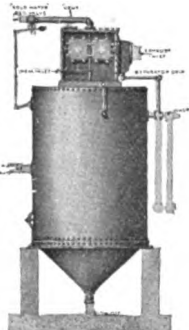
Multiport Valve

For preventing vacuum backing up through the mixed flow turbine to the engine exhaust line and thereby drawing in air to the detriment of the vacuum, use the **Cochrane Multiport Flow Valve**, all explained in the "Multiport Catalog."

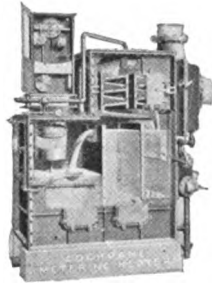


Flow Valve

For protecting the boiling against scale and corrosion, and keeping out sludge and sediment, while at the same time securing all the advantages of heating the water to the maximum temperature, install the **Sorge-Cochrane Hot Process Water Softener**. Due to the use of heat, smaller apparatus is required than with the cold process, and it can usually be installed in the boiler room without special foundations, which at the same time lessens the cost of piping and connections. No independent feed water heater is required. See our new publication on "Hot Soft Water for Steam Boilers."



Softening System



Metering Heater

COCHRANE ENGINEERING SERVICE. For twenty-five years our organization has devoted itself to the profitable utilization of exhaust steam. We have made a specialty of utilizing exhaust steam for heating water for boiler feed and other purposes and for heating buildings, drying materials, operation of low pressure turbines, also for the softening and metering of water. Our skill and experience are at your service, with no further expense to you than the writing of a letter detailing your present conditions and the making of a simple sketch showing your present layout. Even if you have no pressing problem demanding solution, you may obtain valuable suggestions from the Cochrane literature, as mentioned above under the different headings.

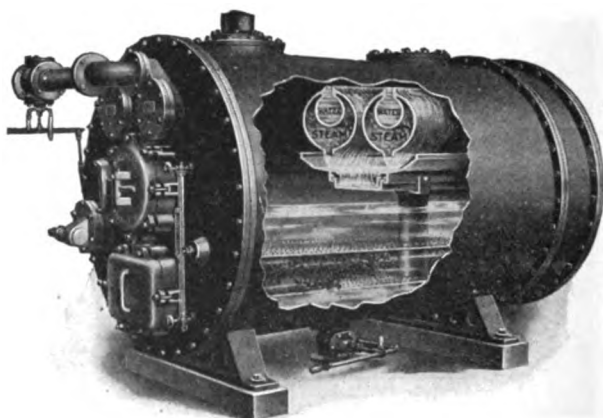
THE NATIONAL PIPE BENDING CO.

BOSTON OFFICE
54 High Street

MAIN OFFICE AND WORKS
NEW HAVEN, CONN.

NEW YORK OFFICE
149 Broadway

Manufacturers of the National Coil or Closed Feed Water Heater. The National Direct Contact Feed Water Heater and Purifier. National Storage Heaters. National Steam and Oil Separators. Coils and Bends of Iron, Brass and Copper Pipe



NATIONAL FEED WATER HEATERS

The feed water is brought to high temperature by direct and actual contact with the exhaust steam, then freed from those impurities which are precipitated by heating, and lastly, filtered before flowing to the pump. It combines in one apparatus a Heater, Purifier, Storage Reservoir and Oil Separator.

The water enters through a regulating valve and is distributed to the smaller or inner pipes which extend the full length of the heater. Overflowing the port at the top, it passes as a thin film over the entire outer surface of the large pipe. During this time it is warmed by the steam in the steam pipe which practically surrounds the water pipe. The exhaust steam after passing through a National oil separator, which forms a part of the heater, escapes from the steam pipe through the port at the bottom and in passing through the curtains of water heats it by actual contact to the temperature of the exhaust steam.

The heated water collects in the tray beneath the pipes and by means of a vertical pipe reaches the bottom of the heater where the scale-forming substances are precipitated. The water then passes upward through the filter material to the hot storage chamber from which the pure hot water flows direct to the pump.

Upward filtration has these advantages: the filtering material needs cleaning or renewal only at long intervals because most of the solids separate out below it, relieving the filter bed of all unnecessary work; in case the perforated plates supporting the filtering material should break, the material will not be carried over to the pump, as would be the case with downward filtration.

A quick-opening blow-off valve at the bottom of the heater affords opportunity to clean the filter bed by reversing the flow.

Described in Catalog No. 52.

THE NATIONAL PIPE BENDING CO.

NATIONAL CLOSED FEED WATER HEATER

For use when the feed water need not be purified. In the National, the feed water is heated while being pumped through a coil of seamless-drawn brass or copper tubing surrounded by exhaust steam. The water is absolutely free from even a trace of oil, for it does not come in contact with the exhaust steam. The brass or copper has no effect on the water.

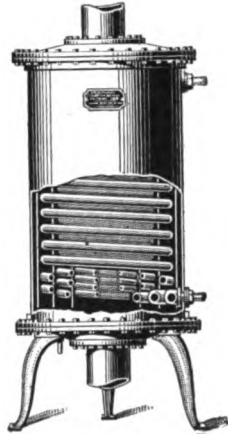
The enclosing shell is of cast iron or steel plate; it lasts indefinitely because the feed water cannot reach it.

The economy resulting from the utilization of exhaust steam varies from 8 to 13 per cent of the coal burned, depending on conditions—temperature of feed water and boiler pressure; but other advantages are reduction of strains caused by feeding cold water, and increase in boiler capacity.

The National is safe—the coils are tested to 600 pounds water pressure, and the shell is subjected to exhaust pressure only.

More than 3,250,000 horse power of these heaters have been installed.

Described in Catalog No. 51.



THE NATIONAL OIL SEPARATOR



Patent applied for

This gravity-type oil separator absolutely removes all grease or cylinder oil from exhaust steam so that the condensation may be used for feeding boilers, in laundry or dye-house service, ice making, or for similar purposes. It has a multi-ported baffle plate, each port having an individual baffle, a distinctive feature found only in the National Separator. The large capacity of this separator not only insures effective separation of oil from exhaust steam but also overcomes the pulsations of exhaust, giving an even flow of steam.



WARREN WEBSTER & COMPANY

Established 1888

MAIN OFFICE AND WORKS, CAMDEN, N. J.

BRANCH OFFICES IN

NEW YORK
PITTSBURGH
INDIANAPOLIS
HOUSTON
LOS ANGELES
SAGINAW

PHILADELPHIA
ATLANTA
CLEVELAND
NEW ORLEANS
DENVER
DETROIT
MILWAUKEE

CHICAGO
CHARLOTTE
MINNEAPOLIS
SEATTLE
WILKES-BARRE
SALT LAKE CITY
ROCHESTER

BOSTON
CINCINNATI
KANSAS CITY
SAN FRANCISCO
WASHINGTON, D. C.
EL PASO

Sole Representatives and Manufacturers for Canada

DARLING BROTHERS, LTD., MONTREAL

ST. JOHNS, WINNIPEG, CALGARY, TORONTO, VANCOUVER, LONDON, ONT.
THE ATMOSPHERIC STEAM HEATING CO., LTD., LONDON, ENG.

THE WEBSTER SYSTEMS OF STEAM HEATING

Vacuum

Hy-Lo

Modulation

Having been pioneers in Vacuum Heating and before the engineering world for 28 years there are few in the line who do not know the reputation we have established for excellence of materials and service.

The devices which go to make up a Webster Vacuum or Modulation System are varied in construction and operation so as to meet all requirements, and standing back of each Webster Installation as we do, it is but natural that we prefer to co-operate with the Architect, Engineer or Contractor in the design and construction of the apparatus. The Webster Appliances are furnished as a complete system.



Webster Syphon Trap

Although the Webster Syphon Trap is by far the best water and air relief trap on the market we find many cases where other traps of our manufacture are better adapted to specific cases, so for this reason we would advise those who specify systems of this type to leave the selection of the devices to us, where we are called upon to guarantee results.

The Webster Modulation Valve is made in several types also and can be applied to the supply connection of any kind of radiating surface using steam as a heating medium.

Universal joint—Extended stem valves for radiators beneath seats

or behind grills, chain control for overhead radiators or coils have been perfected to a point of absolute success.

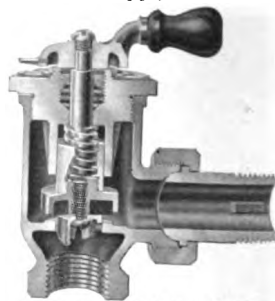
The several types of Webster Modulation Valves are used successfully with or without a vacuum pump according to the nature of the building or buildings in which they are installed, and where applied and operated according to our instructions make it possible to modulate the temperature of a room by measuring the quantity of steam admitted.

The removal of air and water of condensation from radiators, coils or piping is accomplished successfully without steam leakage. The Webster Syphon Trap, the most efficient device for that purpose, operates at any pressure or vacuum from 15 pounds above to 15 inches below atmospheric pressure being compensated for pressure.

A perfect balance within this system can be maintained by the application of our Hy-Lo method with which a high vacuum can be carried on trunk lines and lower vacuums on branches, making lifts and difficult situations easy to overcome.

For Convenience and Economy in heating, there is no better method than "The Webster" and with our trained engineering corps, backed by our ability to make good, the slogan that "The Webster Guarantee is the Owner's Insurance Policy" is a fact and not a theory.

Catalogues and Booklets sent upon request.



Webster Modulation Valve
Type N

WARREN WEBSTER & COMPANY

WEBSTER FEED WATER HEATERS

The Webster Chemical Purifier is a Feed Water Heater and Purifier of the Hot Process Type using simple and cheap chemicals for the thorough purification of hard scale forming boiler feed waters.

All Webster Feed Water Heaters embody the following special features:

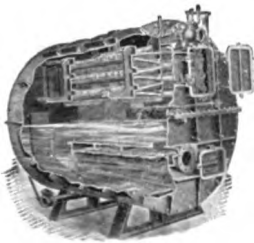
(a) Heating Trays of perforated sheet metal, light, easy to clean, durable and permitting the most intimate intermixture of steam and water because of the small perforations obtainable by the use of such material.

(b) Open Sink Pans (instead of hollow floats)—for automatically controlling water inlets and overflow—positive in action, cannot become inoperative except by abuse.

(c) Complete segregation of oil separator drips from any connection with other openings into the Heater, thus preventing oil contamination otherwise caused by accident or negligence.

(d) Vacuum Principal, by which the Heater assists the passage of steam into itself, thereby reducing back pressure upon engines.

Webster Heaters save (1) Fuel (usually from 10 to 17%), (2) Water (usually from 10 to 14%) as compared with the use of a closed type of heater or with no heater whatever, (3) Boiler repairs due to boiler strains, and (4) Boiler cleaning expense due to their action as Water Purifiers.



Class ED Standard Type

WEBSTER OPEN FEED WATER HEATERS are built in all types and sizes for any conditions of service, space, head-room, etc. They can be furnished either Standard Type (induction principle with Oil Separator attached to Heater shell) or Preference Type (the most improved form of Cut-Out Heater using a Gate Valve in connection with an

Oil Separator of ample size to purify all steam passing through the exhaust main to both the Feed Water Heater and to a Heating or Drying System or to Low Pressure Turbines).

Class "EB"—300 to 12000 horsepower capacities—vertical rectangular pattern—upward flow filtration.

Class "EC"—500 to 7000 horsepower capacities—vertical rectangular pattern—upward flow filtration.

Class "ED"—500 to 15000 horsepower capacities—horizontal cylindrical pattern (particularly adapted for low head-room)—upward flow filtration.

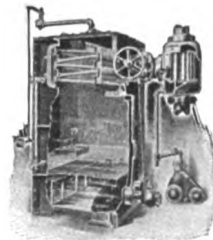
Class "EF"—50 to 350 horsepower capacities—vented rectangular one-piece body type—either upward or downward flow filtration as required.

Catalogues and Booklets sent upon request.

(Continued on next pages)



Class EC Standard Type



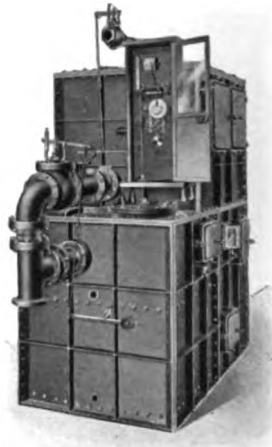
Class EB Cut-Out Type

(Continued from preceding pages)

WARREN WEBSTER & COMPANY

THE WEBSTER-LEA HEATER METER

A practical combination of a thoroughly efficient Feed Water Heater with an accurate V-Notch weir meter so arranged that either unit may be operated with equal efficiency, in combination or independently. Has all the advantages of independent apparatus, as there is no interior connection between the heating chamber and the measuring tank. All floor space and head-room requirements are reduced to a minimum. Division plate between heater and meter prevents direct flow of heated water to meter. Water passes through outside connection which contains a regulating valve operated by a float that is located in the storage chamber for heated and metered water. Flexibility is insured, as either unit may be cut out of service while the other remains in efficient operation. The Patented Extra Storage Type Meter has a large storage chamber for heated and metered water.



Webster-Lea Heater Meter
Patented and Patents Pending

Absolute meter accuracy results because

1. The weir cannot be flooded, even if the Heater were to overflow.
2. Variations in steam pressure in Heater cannot affect water levels in the Meter.

Made in the following types, of cast iron, wrought iron, steel or special materials:

- (a) For exhaust pressure ranging from atmospheric to one pound.
- (b) Equipped with cut-out valve and Preference Oil Separator, for use in connection with any type of heating system, under normal back pressures.
- (c) Made to withstand abnormal back pressures up to twenty pounds per square inch.

Fully covered by patents granted and pending.

Catalogue sent upon request.

WEBSTER STEAM AND OIL SEPARATORS

Webster Steam Separators for the protection and added economy of engines, turbines and pumps, and Webster Receiver Separators giving in addition a means for permitting smaller piping and for equalizing pulsations, are manufactured in types for any direction of flow (horizontal, vertical or angle), of either cast iron or cast steel, and for high or low pressure.



Webster Oil Separator

Webster Oil Separators for either pressure, atmospheric or vacuum conditions and Webster Receiver Oil Separators for use with low pressure turbines or other service are made for horizontal, vertical or angular direction of flow and of several types depending upon operating conditions. Exhaust steam which has passed through any type of Webster Oil Separator may, when condensed, be returned to boilers or used for manufacturing purposes with perfect safety.

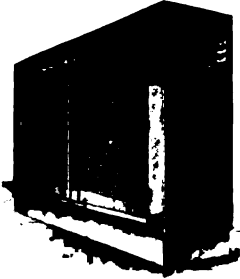
Catalogue sent upon request.



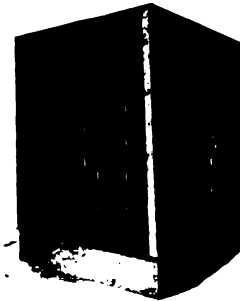
Webster Steam Separator

WARREN WEBSTER & COMPANY

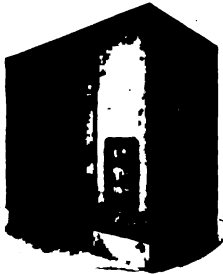
AIR-CLEANSING, AIR-COOLING, DE-HUMIDIFYING APPARATUS
Reclamation of Materials in Connection with Exhaust Systems



The Webster Standard Air Washer



The Webster "Type A" Air Washer



The Webster "Type B" Air Washer

The Webster Standard Air Washer

Designed specifically for Air Cleansing, cooling of the air by evaporation being relatively unimportant. This apparatus commends itself, particularly for the extreme simplicity of its construction, economy of floor space, ease of operation and especially for its effectiveness.

The Webster "Type A" Air Washer

Designed primarily for cooling air by evaporation, the spray water being recirculated. Where a high degree of cooling by evaporation is desired, in addition to Air Cleansing, this apparatus is especially recommended.

The Webster "Type B" Air Washer

Designed primarily for cooling or de-humidifying air by the use of cold well water or water cooled by ice or mechanical refrigeration; it is designed to secure the highest refrigerating effect from the cold spray water. In addition to this it is a most efficient Air Cleansing apparatus and will cool air, by evaporation, to the saturation temperature. This apparatus is particularly applicable in the special requirements of industrial plants, and where constant temperature, humidity or both are required the year round.

The Webster System of Automatic Humidity Control

May be readily applied to the various types of Webster Air Washers. Perfect in principle and accurate in operation. Possesses features that make it practical and simple, among which may be mentioned:

1. Separate control, by ordinary thermostats, of the average dry and wet-bulb temperatures of air leaving the Air Washer.

2. Independent of unequal air and spray distribution and temperature, ordinarily causing unequal humidifica-

tion, supersaturation, inaccurate results, etc.

3. Quick response—the chief controlling thermostat subject to water, a medium with four times the specific heat of air.

4. Inherently safe against over-humidification.

Consult us regarding Air Conditioning Apparatus for any purpose.

Catalogue sent upon request.

WILLIAM ANDREWS, INC.

120 LIBERTY ST., NEW YORK

THE DEOLEIZER

**Removes Oil from Water
Not Part of it—but All of it
Before it Enters the Boiler**

OLEITE is not a "boiler compound." Its use is outside the boiler. It is a crystalline mineral substance which was accidentally discovered to have a marvelous *affinity for oil* when in emulsion,—somewhat like the affinity of cement for water. It will seize every particle of oil in sight,—and once seized it never lets go. The only way to make it let go is to burn the oil off,—and this gives you your OLEITE back again practically as fresh as ever.



The function of the DEOLEIZER is not to take out 90% or 95% of the rough oil in the steam,—many devices do this,—but to take out practically the last minute fraction or trace of oil. This problem, as old as oil itself, and hitherto baffling, is now solved.

No engineer need be told what an absolutely deoleized return feedwater means in clearing his boilers of oil and scale.

Less coal; reduced water bills; less cleaning; smaller repair bills; less insurance cost,—all this and more.

Sizes and Capacities: The DEOLEIZER at present is built in six sizes, numbered, respectively, from No. 1 to No. 6. This is purely an arbitrary designation. Remembering that the function of the DEOLEIZER is to attract and hold the oil, it is obvious that the capacity per day of a certain cubic volume of OLEITE will depend upon whether it is treating a light or heavy emulsion. It is therefore necessary that we should be accurately advised of the conditions of service in each case, whereupon we will recommend that size of DEOLEIZER which in our experience is best adapted to the particular case.

We install strictly on the basis of GUARANTEED results. The responsibility is ours. You keep the DEOLEIZER or the money, whichever you please. And we do not ask for the latter until you are satisfied with the former.

Moreover, we guarantee its annual cost *under contract*.

You may as well learn all the details today as to wait any longer. Therefore send for our Bulletins.



*You can assist us greatly in our
publicity work by referring to this page
as G-2. Our thanks in advance.*

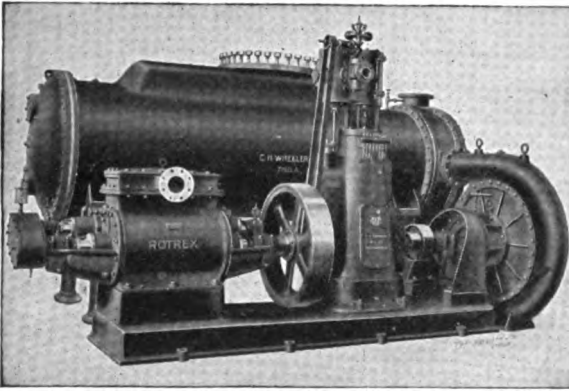


C.H.WHEELER MANUFACTURING CO.

MAIN OFFICE AND WORKS, PHILADELPHIA

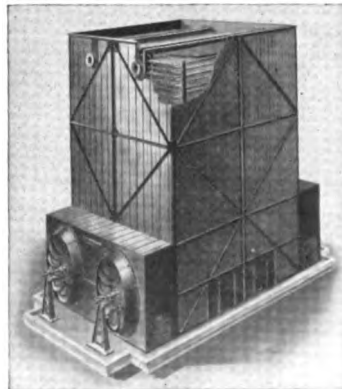
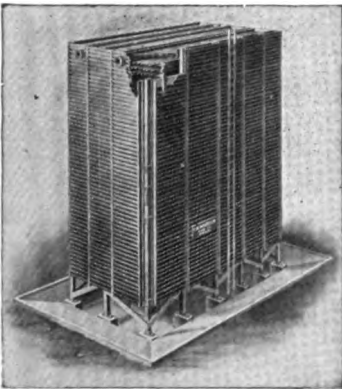
HIGH VACUUM APPARATUS FOR STEAM TURBINES

Surface, Jet and Barometric Condensers. Vacuum Pumps of the Reciprocating, Rotary and Hydraulic Entrainment Types. Water Cooling Towers of the Forced and Natural Draft Types. Centrifugal Pumps, motor, engine, turbine and belt driven. Closed Feed Water Heaters. Heaters for Hot Water Heating Systems and Industrial Purposes. Special Exhaust Gate Valves. Copper Expansion Joints. Multiflex Atmospheric Relief Valves.



High efficiency Surface Condensing Equipment consisting of a C. H. WHEELER Improved Surface Condenser with ROTREX Vacuum Pump and Centrifugal Circulating Pump, both mounted on a base plate and direct connected to a Vertical Enclosed Self Lubricating Engine

85



C. H. WHEELER PRATT Improved Natural Draft Wooden Cooling Towers, also Forced Draft Cooling Towers of Steel, Wood or Concrete construction.

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

WORKS, HARRISON, N. J.

Manufacturers of Surface, Barometric and Centrifugal Jet Condensing Systems, Complete with Auxiliaries; Cooling Towers; Duplex Direct-Acting, Centrifugal, Turbine and Multi-Stage Pumps for Every Service, Boiler Feed, Elevator, Fire, Pressure Pumps; Water Motors; Water Works, Sewage and Drainage Pumping Engines

WORTHINGTON SURFACE CONDENSERS



Containing 35,000 square feet of surface—one of two now installed, each in connection with one 20,000 K. W. Curtis Steam Turbine, by the Edison Illuminating Company of Detroit in their new Connor's Creek Power Station.

A Worthington Condenser is now being built of the same general design for this company but containing 70,000 square feet of surface in a single shell—the largest condenser ever built—for operation in connection with a 45,000 K. W. maximum rating Curtis Turbine.

3150 square foot Worthington Surface Condenser, showing design with large steam dome for small turbines.



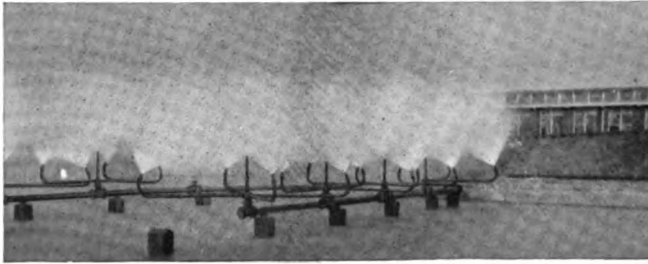
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SPRAY ENGINEERING COMPANY

93 FEDERAL ST., BOSTON, MASS.

Engineers—Manufacturers

"SPRACO" EQUIPMENT FOR COOLING CONDENSING WATER



Spray Cooling Ponds equipped with our special "Spraco" Cooling equipment require only from five to seven pounds pressure per square inch at the nozzle. With this pressure, the water is thrown to a height of from five to seven feet above the tip of the nozzle in a uniform, dense, conical spray. A current of air is created in an upward direction around each nozzle due to its driving effect as well as to the heating effect which the spray has on the air in contact with the water, thus rapidly carrying away the warm, moist air produced and replacing it with cool, dry air brought in over the surface of the pond.

We find from our experience in designing over three hundred ponds, now in successful operation in the United States and other countries, that it is impossible to lay down exact rules for the design of these ponds, as local conditions make each case a special problem. Hence, if the amount of water to be cooled, the amount of steam condensed in heating this water, the cooling or vacuum desired, as well as the dimensions of the space available for the installation and whether on ground or roof are given us we will be pleased to send complete specifications and sketch of arrangement, best suited to conditions given.

87

"SPRACO" AIR WASHERS FOR STEAM TURBINE GENERATORS

As the capacity of the electric generator is directly dependent upon its temperature, which in turn depends upon the air conditions, an ample supply of cool, clean air is of great importance. Dust or soot deposited within the machine greatly reduces the efficiency of air as a cooling medium.

As generators usually reach maximum efficiency at or above full load, our "Spraco" Washers produce the double benefit of higher efficiency and greater capacity.

An average gain in capacity of only 5% on a 5,000 kw. machine means an increase of 250 kw. At \$20 per kilowatt per annum this gives \$5,000 increased earning capacity in one year. The increase for three months—\$1,250—would about cover the cost of the air washer, which would thus pay for itself quickly, and then provide a very large return on the investment.

The cost of cleaning a large generator is high and where the air is unwashed, must be undertaken at least twice a year. This can be largely avoided by the use of our "Spraco" Air Washers.



CRANE CO.

Founded by R. T. Crane 1855

836 So. MICHIGAN AVE., CHICAGO, ILL.

Cable address, Cranecoy, Chicago

Branches in Forty-five Cities

Cast Steel Valves and Fittings; Cranetilt Steam Traps; Valves, Cocks and Fittings in Brass, Malleable Iron and Cast Iron; Steam Specialties; Complete Piping Equipment; Pipe Bends; Pipe Fitters' Tools; Engineers' Supplies, etc.

CRANE CAST STEEL VALVES AND FITTINGS

We have been manufacturing for some time a line of steel fittings to meet a steadily growing demand for a superior grade of goods, especially adapted for High Pressure, Saturated and Superheated Steam Lines and Extreme Hydraulic Service. These are suitable for steam working pressures up to 350 pounds, and for superheat up to a total temperature of 800 degrees.

**No. 7A**

Straight-Way Valve, cast steel body, bonnet, yoke and disc (sizes above 2 inch, disc monel metal faced; 2 inch and smaller, solid monel metal disc), monel metal seats and rolled monel metal stem.

**No. 28A**

Nos. 21A, 23A and B, 27A, 28A and B, 29A and B, 30A and B

Globe and Angle Valves, Stop Check Valves, cast steel body, yoke and swivel disc (sizes above 3 1/2 inch, disc monel metal faced; 3 1/2 inch and smaller, solid monel metal disc), monel metal seats and rolled monel metal or steel stems.

**No. 23A****No. 101D and No. 105D**

Extra Heavy Cast Steel Flanged Fittings.

We carry the following steel goods in stock:

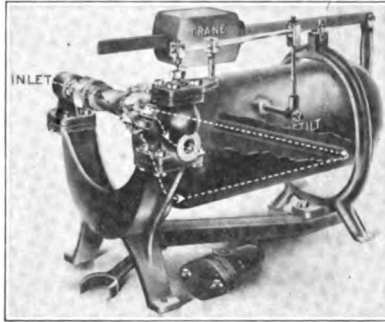
No. 7A Straight-Way Valves	12 inch
Outside screw and yoke, monel seats, rolled monel metal stem	and smaller
No. 9A Straight-Way Valves	14 inch
Outside screw and yoke, monel seats, rolled monel metal stem	and smaller
No. 21A Globe Valves	6 inch
Outside screw and yoke, monel seats, rolled monel metal stem	and smaller
No. 23A and B Angle Valves	6 inch
Outside screw and yoke, monel seats, rolled monel metal, or cold rolled steel stems	and smaller
No. 101D Steel Flanged Elbows	12 inch
Straight sizes	and smaller
No. 105D Steel Flanged Tees	12 inch
Straight sizes	and smaller
Screwed Elbows	4 inch
Straight sizes	and smaller
Screwed Tees	4 inch
Straight sizes	and smaller

CRANE CO.

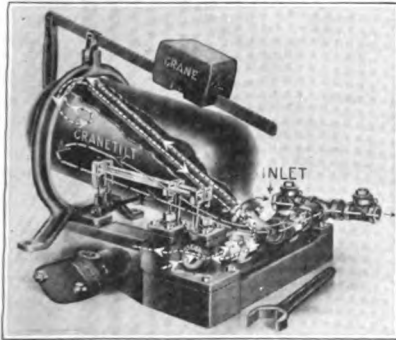
CRANETILT STEAM TRAPS NON-RETURN PATTERN

The receiving or tilting tank is made of malleable iron, cast in one piece of uniform thickness. They are tested to 800 pounds hydraulic pressure per square inch and are fully capable of withstanding the severe strains to which Tilting Traps are subjected.

All operating parts are on the outside and the discharge Valves are of special design, having exceptionally large openings. The brass working parts are made of "Crane Hard Metal" which has wearing qualities almost equal to steel and successfully resists the cutting effects of steam and water.



Size of Trap Number	List Price including Sediment Trap but No Check Valves or Fittings	Pipe Connections Size of Inlet and Outlet Inches	Capacities per Hour Based on Ordinary Condensing Conditions		Dimensions		
			Lineal Feet of 1 Inch Pipe Trap Will Drain with 50 lbs. Pressure at the Trap	Pounds of Water Discharged with 50 lbs. Pressure at the Trap	Extreme Length Inches A	Extreme Width Bed Inches B	Extreme Height Inches C
30	\$25.00	1/4	6,000	1,200	20	12 1/4	20 1/2
32	45.00	1/2	15,000	3,000	25	15	25
33	55.00	3/4	30,000	6,000	28	18 1/2	28
34	85.00	1	50,000	10,000	33 1/2	20 3/4	31
35	115.00	1 1/4	75,000	15,000	36	23	34
36	150.00	1 1/2	100,000	20,000	42 1/2	31 1/2	44
37	200.00	2	150,000	30,000	51	36 1/2	52
38	300.00	2 1/2	200,000	40,000	58	43	59
39	425.00	3	250,000	50,000	64 1/2	50	63



DIRECT RETURN PATTERN

This pattern will automatically return all condensation, at any pressure or temperature, directly back into the boiler. Direct Return Traps require live steam from the boiler for their operation, which is automatically controlled through the steam port of the Duplex Valve. Cranetilt Steam Traps will handle condensation from all sources, under any condition of service, and under any pressure up to 250 pounds. They also have a maximum discharging capacity. Each trap is given a thorough steam test and guaranteed in perfect working order before shipment.

Size of Trap Number	List Price including Sediment Trap, Two Swing Check Valves, Tee and Nipples	Pipe Connections		Capacities per Hour Based on Ordinary Condensing Conditions		Dimensions		
		Size of Water Inlet and Discharge Inches	Size of Steam and Vent Valves Inches	Lineal Ft. of 1 inch Pipe Trap Will Drain	Pounds of Water Trap Will Discharge into Boiler	Extreme Length Inches A	Extreme Width Bed Inches B	Extreme Height Inches C
90	\$60.00	1/2	1/2	4,000	800	25	15 1/4	26
91	75.00	3/4	3/4	7,500	1,500	29	19 1/4	28
92	100.00	1	1	12,500	2,500	34 1/2	21 3/4	34
93	150.00	1 1/4	1 1/4	18,000	3,600	37 1/2	24 1/2	36
94	200.00	1 1/2	1 1/2	25,000	5,000	42 1/2	31 1/2	43
95	300.00	2	2	39,000	7,800	51	36 1/2	52
96	400.00	2 1/2	2 1/2	57,500	11,500	58	43	56
97	550.00	3	3	77,500	15,500	64 1/2	50	64
98	750.00	4	3	140,000	28,000	74	53	72

(Continued on next pages)

(Continued from preceding pages)

CRANE CO.

CHICAGO, ILL.

SUMMARY OF CRANE PRODUCTS

We give on this and the succeeding page a description of our line. We carry in stock at our branch houses a large supply of the goods listed below and are prepared to furnish Special Valves, Fittings, etc., to meet specific requirements or conditions, without delay.

The term Standard is applied to those goods intended for steam working pressures not exceeding 125 pounds. The Low Pressure Fittings, etc., may be used for Steam Working Pressures up to 25 pounds, while the Medium Goods are intended for 175 to 225 pounds. The Extra Heavy are designed for Steam Working Pressures up to 250 pounds.

The proportionate Water Working Pressure may be taken as follows: Low Pressure, Standard and Medium, 40 per cent greater than the steam pressure on sizes 12 inch and smaller; sizes 14 inch and larger, 20 per cent greater.

STANDARD GOODS

We manufacture brass Globe, Angle and Cross Valves, screwed, in sizes from $\frac{1}{8}$ to 4 inches; and the flanged pattern from $\frac{3}{4}$ to 4 inches. The brass Check Valves are made in many patterns, the sizes of which run from $\frac{1}{8}$ to 3 inches. The brass line also includes: Hose, Garden Hose, Coke Oven, Needle Point, Straight-Way and Hose Gate. Our lines of Radiator Valves and Fittings, brass Steam and Gas Cocks are complete. The Cast Iron material includes Cocks of various patterns; Globe, Angle and Cross Valves with yoke as well as the regular patterns; the sizes ranging from $\frac{1}{2}$ to 16 inches. We handle Brass and Cast Iron Pipe Fittings in both the screwed and flanged patterns as well as Malleable Pipe Fittings screwed. With the Standard Goods are also included iron Straight-Way Valves, Expansion Joints with iron body and brass sleeve, Railing Fittings, Drainage Fittings, Steam Fitters' and Engineers' Tools, Pipe Bends, and Pipe Supports, Brackets, etc.

LOW PRESSURE GOODS

The regular low pressure Straight-Way or Wedge Gate Valves are made in several patterns and in sizes up to 72 inches. The low pressure Pipe Fittings are of the flanged pattern and include Elbows, 45 degree Elbows, Tees, Reducing Tees, Crosses, Reducing Crosses, Long Radius Elbows, Base Elbows and Tees with square and round base and Taper Reducers.

MEDIUM PRESSURE GOODS

This line includes the Crane Navy Globe, Angle, Cross and Check Valves made of Crane Special Brass, the screwed pattern being made in sizes ranging from $\frac{1}{4}$ to 4 inches and the flanged pattern from $\frac{3}{4}$ to 4 inches. The brass Straight-Way or Wedge Gate Valves come with non-rising stems, either screwed or flanged, while the rising stem pattern has a yoke and is screwed. We also make in the medium class, Globe, Angle and Cross Valves with Ferrosteel body, flanged in sizes ranging from 2 to 12 inches; the Straight-Way or Wedge Gate Ferrosteel Valves are made in sizes up to 24 inches.

CRANE CO.

EXTRA HEAVY GOODS

Under this heading will be found Ferrosteel Straight-Way Valves in ten patterns, including the Electrically and Cylinder Operated Design; the sizes run up to 24 inches and larger. The Ferrosteel Globe, Angle and Cross Valves are made with yoke, have hard metal seats and are flanged; the sizes range from 2 to 15 inches. The Extra Heavy Valve line also includes Swing Check Valves, flanged, sizes from 2 to 15 inches; Automatic Stop-Check Valves in Globe and Angle Pattern, flanged, sizes 2 to 10 inches; Expansion Joints—iron body and brass sleeve, in sizes 2 to 18 inches—these are also made with special traverse and extra long traverse; Balanced Expansion Joints; Globe, Angle, Cross and Check Valves; Regrinding Swing Check Valves; Horizontal Check Valves; Unions, Rough Brass Fittings, Malleable Iron Fittings, Cast Iron Flanged Fittings, Gaskets, Flanged Pipe Joints.

HYDRAULIC GOODS

The complete line includes material for various water working pressures up to 10,000 pounds, depending upon the article. It includes Straight-Way Valves with non-rising stem and with outside screw and yoke, with or without by-pass in sizes 1½ to 12 inches; Swing Check Valves in sizes 2½ to 12 inches, inclusive; Globe, Angle and Check Valves, Malleable Iron Fittings, Brass Unions, Ferrosteel Flanged Fittings and Companion Flanges, Cast Steel Valves, Fittings and Flanges and Forged Steel Valves and Fittings.

91

PIPE

We can supply promptly Seamless Drawn Brass and Copper Tubing in iron pipe sizes, Standard Weight Spiral Riveted Pressure Pipe, Straight Steam Steel Riveted Pipe, and Wrought Pipe—either black or galvanized.

SPECIALTIES AND TRIMMINGS

These are Automatic Exhaust Relief Valves, Automatic Stop-Check Valves, Emergency Engine Stop Valves, Line Protection Valves, Electrical Temperature Control Valves, Chicago Railroad and Navy Unions, Boiler Fittings, Crane Cement for making tight pipe joints, Steam Whistles, Water Gauges, Oil and Grease Cups, Lubricators, Cocks, Pressure and Vacuum Gauges, Fusible Plugs, Back Pressure Valves, Pop Safety Valves, Blow-Off Valves, Blow-Off Crosses, Pressure Regulators, Float Valves, Exhaust Pipe Heads, Injectors, Automatic Duplex Feed Pumps and Receivers, Pumps, Flexible Joints, Cranite Packing, E. C. & B. Pipe Machines, Steam and Oil Separators, Crane Vacuum Oil Separators, Machine Bolts.

POCKET CATALOGUE

The No. 40 Crane catalogue lists our complete line in a compact form. It will be sent upon request.



THE DARLING PUMP & MFG. CO. Ltd.

WILLIAMSPORT, PA.

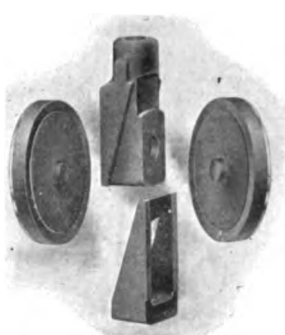
NEW YORK CITY
149 Broadway

SALES OFFICES:
CHICAGO
The Rookery

PHILADELPHIA
Commercial Trust Bldg.

Manufacturers of Darling Gate Valves, Ball Check Valves, Fire Hydrants,
Floor Stands, Indicator Posts, Valve Boxes

DARLING GATE VALVES



Wedging Mechanism—Shown with
Parts Separated

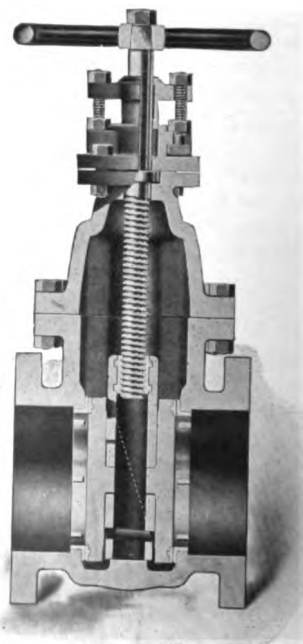
The Gate Discs being plain, no portion of the Wedging Mechanism is formed upon them. These Gate Discs revolve independently of the wedges, and independently of each other. The Revolving Gate Discs change their positions on the Seats each time the Valve is closed, thus distributing wear equally over entire faces of Gates and Seats, ensuring durability.

Gates released before opening, avoiding wear on Seats. Cannot stick or bind.

Simple, reliable, durable.

Darling Valves will remain tight longer than any others. They are made for all pressures and purposes.

The Darling Patented Gate Valve differs from all others in that it has Parallel Seats, Double Revolving Gate Discs and Compound Equalizing Wedges. The Wedging Mechanism operates between the Gate Discs and independent of them.



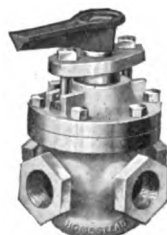
Sectional View of Inside Screw Valve
with Flanged Ends

HOMESTEAD VALVE MFG. CO.

P. O. Box 1754, PITTSBURGH, PA.

Manufacturers of Homestead Valves and Other Specialties

HOMESTEAD (Quarter Turn) PLUG VALVES OR COCKS



The first illustration shows our Homestead Straightway Valve, with flanged connections. This pattern is used extensively as a boiler blow-off valve.

Homestead Valves are equally serviceable on all kinds of exacting or high pressure work.

The three-way and four-way valves as shown on the second and third illustrations are used as operating valves on air, water, steam and for many other purposes.

Homestead Valves are so constructed that they open and close with a quarter turn, operate easily and are free from leakage through the valve, the stuffing box or body.

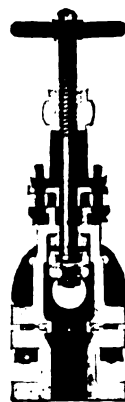
HOVALCO (Blow Off) VALVE

The valve here shown is a new pattern angle blow-off valve, Semi-steel body, Nickel composition seat and disc. The disc and seat are reversible, renewable and can be reground, note the accessibility and the ease with which the parts of this valve can be renewed.



This figure shows the "Homestead" and "Hovalco" valve combined. For boiler blow-off

purposes, no better arrangement can be secured. The advantages of the double blow-off arrangement are many, the "Hovalco Valve" can be repaired or renewed at any time without closing down the boiler. This is done by closing the "Homestead Valve," while the repairs are being made. The best power plants being built are specifying this arrangement of blow-off valves. In accordance with the Am. Soc. M. E. Boiler Code.



Section of Hovalco Valve

Catalogue of our complete line sent upon request.



THE KELLY & JONES CO.

GREENSBURG, PA.

Manufacturers of Cast Iron, Malleable, Brass and Steel Fittings; Brass, Iron Body and Steel Valves, Cocks, Etc., For Steam, Gas, Water, Air and Oil



Cast Iron Fitting

CAST IRON, MALLEABLE AND BRASS FITTINGS

We make every conceivable style and size of screwed cast iron, malleable, brass and steel fittings and for all pressures.

All of our screwed fittings are recessed to permit of the easy entrance of the pipe and threads are cut true to gauge. Will not leak and each fitting a perfect product.



Malleable Fitting



Flanged Fitting

FLANGED FITTINGS

We make a flanged fitting for every pressure and purpose, brass, iron or steel, and in all sizes, straight or reducing.

Dimensions and drilling in accordance with the latest established standards.



Reducing Flanged Fitting

JENKINS TYPE KELLY & JONES BRASS VALVES

Practical—durable—efficient—economical. Will not leak and can be repacked under full pressure. These K-J Jenkins type brass valves are made of the highest grade steam metal, carefully machined, and are very attractive in appearance. Special pattern for 100 lbs. standard for 125 lbs.

Furnished in globe, angle, cross and check, screwed or flanged, and in all sizes.

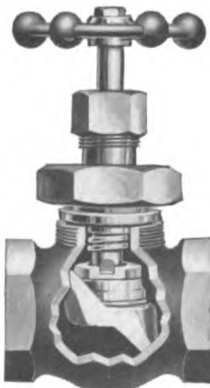
"EXCELSIOR" HIGH PRESSURE BRASS VALVES

For high pressure service, 200 or 300 lbs. of live or superheated steam. Used extensively in modern steam plant construction and in the U. S. Navy. Can be furnished with or without yoke, screwed or flanged, globe, angle, cross and check. Sizes from $\frac{1}{8}$ " to 4".

BRASS GATE VALVES

The Kelly & Jones line of brass gate valves is most complete. Correctly designed and well proportioned and can be furnished screwed or flanged for the following pressures: 100 lbs., 125, 150, 175, 200, 250 and 1000 lbs. Made with outside screw and yoke if desired for 125 or 250 lbs. pressure.

In addition to the solid wedge type illustrated we make brass gate valves with the double disc, either parallel or taper seats.



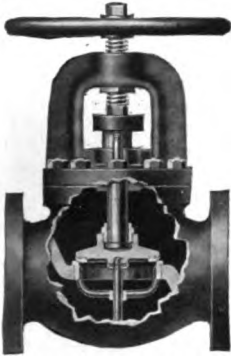
"Excelsior"
High Pressure Brass Valve



Brass Gate Valve

THE KELLY & JONES CO.

Send for Catalog "O" illustrating and describing our complete line of valves and fittings.
Our new steel foundry is fully equipped for making in "high quality" steel, any of the valves or fittings shown in our general catalog.



Iron Body Globe Valve

IRON BODY VALVES

All styles and sizes for all pressures and purposes including globe, angle, cross, check and safety valves. Screwed or flanged, inside screw or O. S. & Y.

K. & J. blow-off valves, globe or angle, screwed or flanged, perform their function correctly and positively, and thereby prolong the life of the boiler. Built on scientific principles and have been in satisfactory use for years.



Globe Blow-Off Valve

"SADDLE" GATE VALVES

All Iron or Iron Body Brass Mounted

This saddle style is a very durable and compact valve, and economical, owing to the simplicity of construction. The steel saddle around the body of the valve holds the bonnet securely in place, and can easily be removed, permitting of access to the interior of the valve for cleaning or repair purposes. Opens to the left and has a rising spindle.

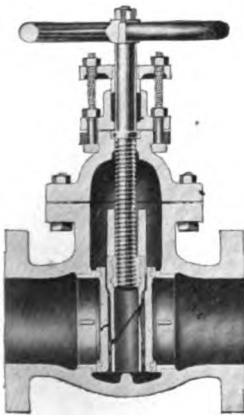
The solid disc in this valve is very narrow and V-shaped at the bottom, and can, therefore, be seated more readily when dirt and sediment are collected between the seats in the valve. Screwed or flanged, sizes $\frac{1}{2}$ " to 6".



"Saddle" Gate Valve



Iron Body Gate Valves
Solid Wedge



Iron Body Gate Valve
Double Disc

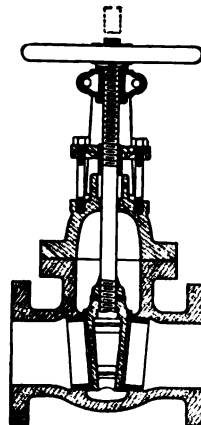
IRON BODY GATE VALVES

Solid Wedge or Double Disc

Our iron body gate valves can be furnished screwed or flanged, with or without yoke and by-pass and for 25, 125, 175, 250 and 1000 lbs. pressure.

These valves are also made all iron for temperatures exceeding 325° Fahrenheit and for handling cyanides, acids and other solutions injurious to brass.

We also make these gate valves with the double disc, parallel or taper seats.



JENKINS BROS.

80 WHITE ST., NEW YORK

133 NO. SEVENTH ST., PHILADELPHIA

524 ATLANTIC AVE., BOSTON

300 W. LAKE ST., CHICAGO

JENKINS BROS., LIMITED

103 St. Remi St., MONTREAL

95 Queen Victoria St., LONDON, E. C.

JENKINS RUBBER CO., ELIZABETH, N. J.

Manufacturers of Jenkins Bros. Valves; Sheet Packing, Pump Valves and other Mechanical Rubber Goods



Fig. 352
Sectional Views of
New Standard
Pattern Brass
Swing Check Valve

JENKINS BROS. BRASS VALVES

Jenkins Bros. Brass Valves, Standard Pattern, are made in globe, angle, cross, check, safety, Y and radiator patterns.

They are the original renewable disc valves.

The Jenkins Discs, with which they are fitted, are of special rubber composition, readily adapting themselves to the raised seats ensuring absolutely tight closure. As there is no metal-against-metal contact of seats, there is less abrasion and wear, and the labor of regrinding is obviated. Jenkins Bros. Discs are inexpensive, give long service, and when worn out can be readily renewed without removal of valves from piping. As regularly supplied, valves are fitted with discs of hard composition for steam service. For cold water, air or gas, discs of softer composition are recommended. The valves are guaranteed for working steam pressures up to 150 pounds.

JENKINS BROS. IRON BODY VALVES

Jenkins Bros. Iron Body Valves, Standard Pattern, are made in globe, angle, cross, check, Y, safety and back pressure patterns. They are heavy and strong. The working parts are similar in construction to the standard pattern brass valves, and they are regularly fitted with Jenkins composition discs. All parts, including raised seat, are interchangeable and renewable. Guaranteed for working steam pressures up to 150 pounds.



Fig. 162
Sectional View of
Iron Body Globe
Valve, Extra Heavy
Pattern

JENKINS BROS. EXTRA HEAVY VALVES



Fig. 128
Sectional View of
Brass Globe Valve,
Extra Heavy Pattern

Jenkins Bros. Extra Heavy Valves are designed for 250 pounds working pressure. The Globe, Angle and "Y" or Blow-off Valves are made in brass, either screwed or flanged, sizes $\frac{1}{4}$ to 3 inches, and iron body 2 to 12 inches inclusive. The valves are well designed, made of the very best steam metals and great care is taken with the workmanship. The spindles are large and have powerful Acme standard threads.

The stuffing boxes are also large and arranged so that they can be packed under full pressure when wide open. They are fitted with renewable steam metal discs when used for steam, with Jenkins Discs for cold water service, and also have removable seat rings which can be reground or renewed when necessary.

A full line of Extra Heavy Horizontal, Angle and Swing Check Valves is also made equally heavy in design and can be recommended as being fully adapted to the service required.

As regularly made, all these Extra Heavy Valves are tested to 800 pounds hydraulic pressure. The factor of safety is so high, however, that the test pressure can be increased to double this figure if required and the valves may be safely used on hydraulic or air pressures up to 800 pounds.



JENKINS BROS.

JENKINS BROS. EXTRA HEAVY AUTOMATIC EQUALIZING STOP AND QUICK VALVES

are designed to shut off, automatically, the flow of steam from the header to a boiler in case a tube should burst or other internal rupture occur, thereby suddenly reducing the pressure in the boiler. They also serve to equalize the pressure in a battery of boilers and prevent one boiler from working at a lower pressure than the others. As the valves can only be opened by the pressure in the boiler it is impossible to turn steam accidentally into a boiler which is being cleaned. To prevent chattering, the valve is cushioned by an internal dashpot made of bronze which eliminates all danger of sticking through corrosion.

Each valve is carefully tested to 800 pounds hydraulic pressure and is guaranteed for working steam pressures up to 250 pounds. The stuffing-boxes can be packed when valve is wide open under full pressure.



Fig. 293
Sectional View of Auto-
matic Stop and Check
Valve, Angle Pattern

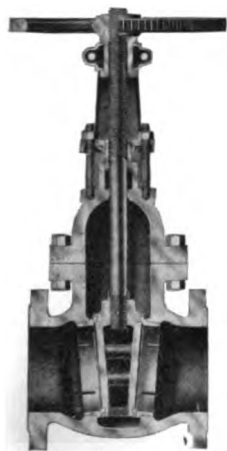


Fig. 245
Sectional View of Extra
Heavy Iron Body Gate with
Outside Screw and Yoke

JENKINS BROS. GATE VALVES

are a comparatively new, and distinctly high-grade line. They are made in brass or iron body in three distinct patterns: Standard, for 125 pounds working steam pressure, or 175 pounds water; Medium, for 175 pounds steam or 250 pounds water; Extra Heavy, for 250 pounds steam or 400 pounds water.

They are all of the solid-wedge, double-face type. The wedge or gate is guided by ribs cast on the inside of the body, which fit in corresponding channels in the wedges, thereby preventing the wedge from dragging across the seat, preventing uneven wear on the faces, or chattering when valve is partly open.

One of the important features of these valves is the improved globe-shaped body, a novel design which is used because it secures the greatest possible strength, good proportion and neat appearance.

The brass valves are regularly made in sizes $\frac{1}{4}$ to 3 inches. Larger sizes in brass can be made from iron body patterns.

Standard Iron Body Valves made in sizes 2 to 30 inches; Medium up to 18 inches; Extra Heavy up to 24 inches.

JENKINS BROS. CAST STEEL VALVES

are made in Globe, Angle, Gate and Check Patterns, which experience has shown are perfectly adapted for the severe conditions incident to high-pressure superheated steam service. The steel used in these valves is made in a modern converter from selected irons and for strength, ductility and soundness the castings are fully equal to those produced commercially by any known process.

For seat-rings, discs, bushings, and spindles Monel Metal is used, a natural alloy containing about 70 per cent nickel. The tensile strength is high, it is very hard, durable and non-corrosive and expands and contracts practically the same as cast steel. Seat-rings made of this metal do not get loose under the most severe conditions.

The valves are suitable for working steam pressures up to 350 pounds, and total temperature of 800° F.

All the genuine Jenkins Bros. Valves bear the Diamond Trade Mark, and are absolutely guaranteed to be perfect in workmanship and suitable and efficient in the service for which they are designed.

A catalogue of all the Jenkins Bros. products, giving sizes, styles and list prices, mailed on request.



Fig. 250
Sectional View of
Iron Body Gate,
Inside Screw



THE KENNEDY VALVE MFG. CO.

MAIN OFFICE AND WORKS

1100 E. WATER ST., ELMIRA, N. Y.

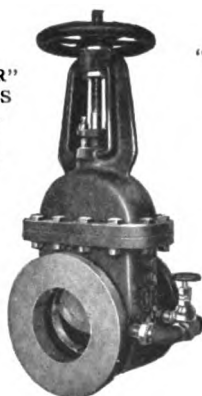
AGENCIES

81 John St., New York City 602 Western Union Bldg., Chicago
415 French Savings Bank Bldg., San Francisco 604 Canal-Louisiana Bank Bldg., New Orleans

**Manufacturers of Gate, Globe, Angle, Check, Radiator and Indicator Valves
For Power, Heating, Fire Protection, Water Supply, Etc.; Fire Hydrants**



**HEAVY
"LENTICULAR"
GATE VALVES**
With Double
Discs,
Taper Seats

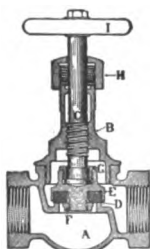


**"STANDARD"
BRONZE
GATE
VALVE**



Screwed

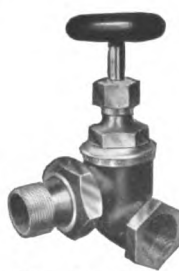
GLOBE, ANGLE, RADIATOR AND CORNER VALVES With Renewable Disc



Sectional View
Globe Valve



Angle Type



Offset Corner Type

SWINGING CHECK VALVES

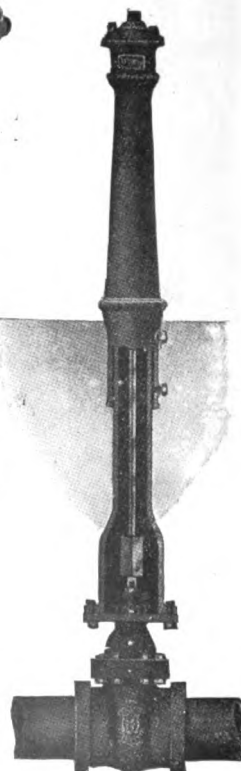


Bronze



Iron Body
Bronze Mounted

Write for recently
issued catalogue
describing all the
above and many
other kinds of
valves.



Indicator Post Valve

ROE STEPHENS MFG. CO.

DETROIT, MICH.

Manufacturers of Valves for Steam, Water, Air and Gas

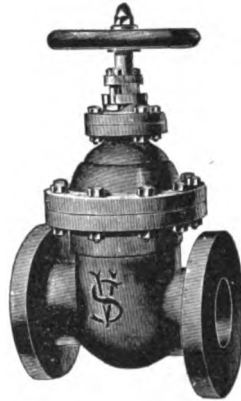
SCOTT'S HIGH GRADE VALVES

All Kinds and for All
Pressures

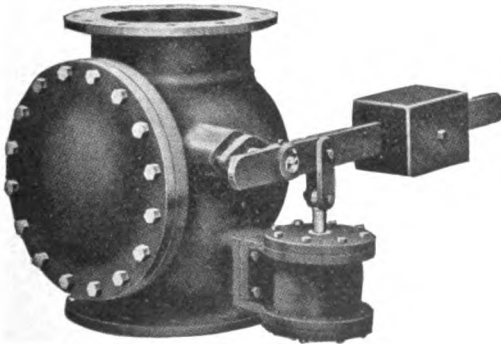
Straightway Gate, Globe,
Angle, Swing Check, Throttle,
Hot Water and Steam Radi-
ator, Pop Safety and Relief,
Back Pressure and Exhaust
Relief.



Scott Gate Valve with
Outside Screw and
Yoke



Scott Gate Valve with
Stationary Stem



Scott Back Pressure Valve

We make a full line of Valves of both the Celebrated "Scott" or "Michigan" patterns.

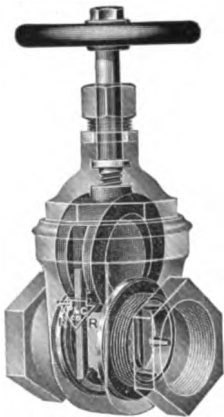
Send for our Catalogue and look over our Complete Line.

776359

PRATT AND CADY CO., INC.

HARTFORD, CONN.

Manufacturers of Valves, Cocks and Hydrants



Renewable Seat Gate Valve

RENEWABLE SEAT GATE VALVES

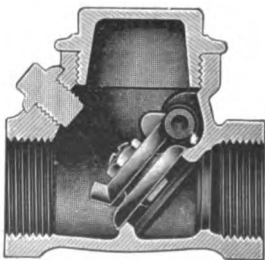
Bronze and Iron

All styles for all pressures. Sizes up to 24 inches. With renewable seat rings, held in place by separate retaining rings easily removable.

The seat rings are independent rings of bronze, or any special metal or material best adapted for the service in which the valve is to be used. The gate is a double faced, wedge shaped casting, with side grooves by means of which it slides on guides in the valve body.

Gauges are used in machining all parts to insure their accuracy and interchangeability.

The guides in the bodies are of equal thickness, and the wedge can be taken out of the valve and replaced with the opposite faces in contact, and will give an accurate fit. The importance of this in making repairs is obvious. These valves being double seated, can be used with the pressure applied at either end.



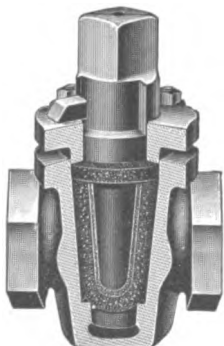
Regrinding Swing Check Valve

REGROUNDING SWING CHECK VALVES

Bronze and Iron

All styles for all pressures, sizes up to 36 inches.

The design combines pressure resistance with easy flow lines. Material (of brass valves) is 86% pure copper. Each valve is tested to an adequate pressure. All seats are carefully ground. Assembling is done by expert mechanics. The interior construction permits the replacement of any working part without removing valve from line. For regrinding no tool is necessary but a wrench and brace and bit.



Asbestos-Packed Cock

ASBESTOS-PACKED COCKS

Bronze and Iron

Made in sizes $\frac{1}{8}$ inch to 8 inches, for all pressures.

The dovetailed, U-shaped grooves in the body are packed with prepared asbestos. An asbestos ring is used on the shoulder of the plug for top packing.

The plug is of standard taper carefully finished and barfed to render it rustless. It has no metallic bearing, coming in contact only with asbestos, the elasticity of which compensates for the differential expansion and contraction of the plug and body. The gland admits of adjustment by means of its bolts.

These cocks give exceedingly satisfactory results as boiler blow-offs and water column blow-offs, between check and boiler, between water column and boiler, and they do work where ground plug cocks, globe, angle or gate valves fail.

PRATT AND CADY CO., INC.

ASBESTOS DISC GLOBE AND ANGLE VALVES

Made in sizes $\frac{1}{4}$ inch to 3 inches for 150 lbs. pressure. The stuffing box gland is long, heavy and well fitted.

The spindle collar, and its point of contact with the bonnet, have specially smooth surfaces and make a steam-tight joint when valve is fully open.

The disc holder is guided by four splines in the body, assuring perfect alignment at all times. The disc holder is of the horseshoe type, and can be removed and replaced, the only tool necessary therefor being a wrench to unscrew the bonnet.

The seat is rounded, thus preventing the settling thereon of any substance that might hold the disc from going squarely to its place. The bronze in these valves is approximately 86% pure copper.

CAST STEEL GATE VALVES FOR SUPER-HEATED STEAM

All tested to a hydrostatic pressure of 800 lbs., suitable for 250 lbs. pressure and 200 degrees superheat.

All valves $2\frac{1}{2}$ " to 6" are equipped with cast steel bodies, bonnets, yokes and nickel-bronze wedges.

Valves 7 inches to 16 inches have cast steel wedges.

The seats and faces of the wedges are made of nickel-bronze, securely fastened in place so that they cannot work loose.

Stems are cold rolled steel.

All bolt holes are spot faced.

Bonnet joint is packed with the best grade of super-heat packing.

The end flanges have $\frac{1}{8}$ " raised faces, extending full width inside of bolt holes, with smooth finish.

All bolts have hexagon heads and nuts, with their under sides semi-finished.

The discs can be furnished either split or solid wedge pattern.

Stuffing box is made with hinge bolts, very deep for square packing.

AUTOMATIC NOISELESS STOP AND CHECK VALVES

Made in iron body in sizes 2" to 10" from both globe and angle patterns, with either screwed or flanged ends for pressures up to 250 pounds to the square inch.

For use between the main steam header and each boiler of a battery.

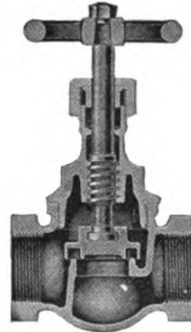
Closes automatically if the boiler pressure should be reduced through any cause.

Acts as an equalizing valve between the units of a battery, remaining closed until the boiler pressure reaches the same degree as that in the header.

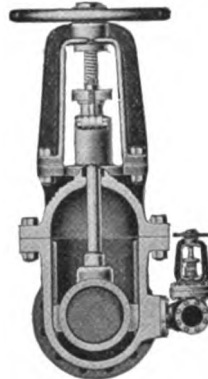
Can be used as a positive stop valve by using the hand wheel to force the disc to its seat.

The internal dash-pot, the piston, and the disc are made of bronze to prevent corrosion.

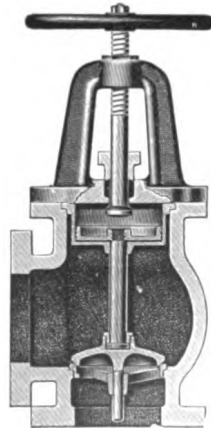
If required for controlling superheated steam, these valves can be furnished in cast steel with nickel-bronze working parts. When so made, they are suitable for pressures up to 250 pounds and total temperatures not exceeding 800 degrees Fahrenheit.



Asbestos Disc Globe Valve



Cast Steel Gate Valve



Automatic Noiseless Stop and Check Valve

PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

PITTSBURGH, PA.

BRANCH OFFICES AND AGENTS

NEW YORK OFFICE, 30 Church St.
CLEVELAND OFFICE, 226 E. Ohio Gas Bldg.
BIRMINGHAM, ALA., Young & Vann Sup. Co.,
1809 First Ave.
BISBEE, ARIZ., Carl Clausen, Eng. Office.
CHICAGO, ILL.

DENVER, COLO., Mountain States Mach. Co.
PHILADELPHIA, PA., 1323 Widener Bldg.
SALT LAKE CITY, UTAH, Utah Eng. &
Machinery Co.
SAN FRANCISCO, CAL., E. A. Keithley,
Rialto Bldg.

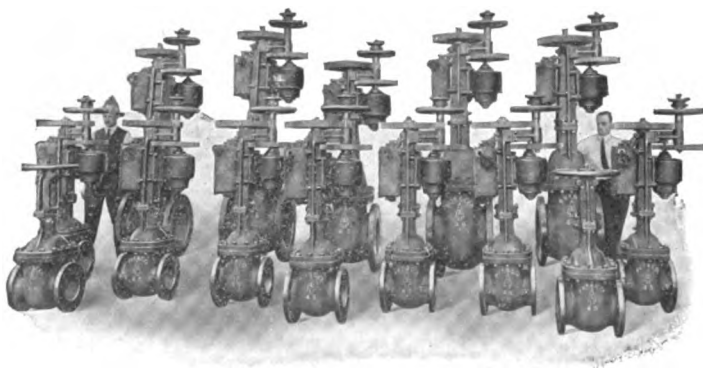
TORONTO, ONT.

Engineers, Manufacturers and Erectors

Valves, Fittings and Appliances of every description for Steam, Gas, Water, Air and Hydraulic Piping. Complete piping contracts executed—designed by experienced engineers, manufactured by skilled workmen under intelligent supervision and erected by expert fitters.

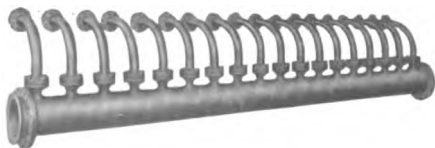
Special Valves and Sluice Gates for hydraulic installations, Motor Operated and Cylinder Operated. Hydraulic Operating Valves for blast furnace doors and bells, and for steel mill tables and rolls.

Special facilities for casting and machining large pipe fittings, furnace castings, etc.



Group of Motor-Operated Gate Valves

Pipe cutting, bending and welding. Branches and manifold outlets fabricated by the patented Interlock Method.



16" Welded Header with 18-4" Branches



PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.

STANDARD LINES OF GATE VALVES

Specifications for material	Grey Iron—22,000 lb. per sq. in. tensile strength. Semi Steel—33,000 lb. per sq. in. tensile strength.
Parallel seat 50 lb. working pressure 100 lb. test pressure	Sizes 14" to 72" cast iron. Low pressure. For water, gas, air or exhaust steam. Extremely close face to face, invaluable in complicated piping connections.
Parallel seat 125 lb. working pressure 300 lb. test pressure	Sizes 2" to 48" cast iron. Standard pressure. For water, air, steam or gas. Fully bronze mounted. Especially adapted to water distribution.
Parallel seat 200 lb. working pressure 400 lb. test pressure	Sizes 1½" to 16" cast iron. Largely used for natural gas under the lower pressures. Furnished either all iron or iron body bronze mounted.
Parallel seat 400 lb. working pressure 800 lb. test pressure	Sizes 3" to 20" semi steel. In extensive use for the transmission of natural gas. Furnished either with or without bronze mountings.
Parallel seat 500 lb. working pressure 1500 lb. test pressure	Sizes 2" to 12". For water or oil at pressure noted. Semi steel with solid bronze mountings.
Parallel seat 1000 lb. working pressure 1500 lb. test pressure	Sizes 2" to 12" semi steel. High pressure gas valve used chiefly at the gas wells and on feeders in the gas fields.
Parallel seat 1500 lb. working pressure 2000 lb. test pressure	Sizes 2" to 10" semi steel. For hydraulic service and extreme natural gas rock pressures.
Taper seat 175 lb. working pressure 500 lb. test pressure	Sizes 2" to 16" semi steel. A valve for medium steam pressures from 125 lb. to 175 lb. where a less expensive valve than the 250 lb. type is desired.
Taper seat 250 lb. working pressure 800 lb. test pressure	Sizes 1½" to 28" of semi steel with solid bronze mountings for ordinary steam pressures. Sizes 2" to 24" for superheat steam up to a temperature of 500 degrees Fahrenheit of cast steel with full monel mountings, monel stems and cooling chamber to protect packing.
Taper seat 1000 lb. working pressure 2000 lb. test pressure	Sizes 2" to 10". The strongest valve possible to make in its weight, all surfaces being cylindrical or spherical segments.
Gate valves for any pressure	Designs and quotations furnished for valves for special conditions or higher pressures. Materials used are those best adapted to service.



50 lb. Parallel Seat Gate Valve. Close Pattern



14" Cast-Steel Gate Valve for Superheat Steam



4" 1000 lb. Gas Line Gate Valve

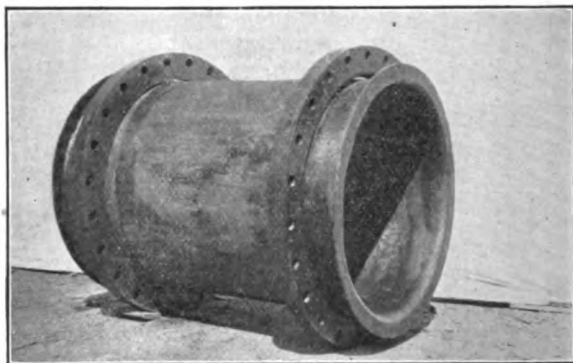


8" 1000 lb. Hydraulic Gate Valve

JOHN SIMMONS COMPANY

110 CENTRE ST., NEW YORK

Iron Pipe, Fittings and Valves

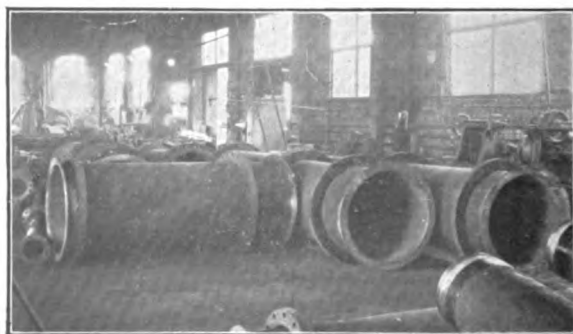


24" O. D. Van Stone Joint

In our New York City plant, in addition to a large and varied stock of material for STEAM ENGINEERING, including WROUGHT IRON and WROUGHT STEEL PIPE $\frac{1}{8}$ " to 18" inclusive, we have a pipe-cutting department, cutting up to and including 18" and a fully equipped machine shop for all work connected with Steam Engineering.



Wrought Steel Welded Header



30" Van Stone Joints

CENTRAL FOUNDRY COMPANY

90 WEST STREET, NEW YORK

CHICAGO

ATLANTA

SAN FRANCISCO

DALLAS

Manufacturers of Soil Pipe, Universal Pipe, F. & W. Fittings, General Castings



Sectional View of "Joint" Showing Machined Universal Joint with Bolts in Position through Ends

UNIVERSAL PIPE

Universal Pipe is cast iron pipe with hub and spigot ends, the contact surfaces of which are machined on a taper giving a natural iron to iron joint, which is permanently tight. By making the tapers of slightly different pitch the joint provides for expansion and contraction, vibration and uneven ground settlement.



TRADE MARK

The lengths of pipe are drawn together by bolts, two bolts to a joint sufficing except for pressures above 175 pounds. The pipe can therefore be laid at a slight labor cost, and without caulking. No

molten lead, oakum, etc., required. No equipment, except two wrenches.

The iron to iron contact of the Universal Joint eliminates electrolysis. The result is a pipe that *does not leak, and continues not to leak*, with a joint that, as long as cast iron lasts, will remain tight under pressures even up to 500 pounds.

High Pressure Service: Universal Pipe is especially adapted to high pressure service, and particularly for high pressure fire lines. There is no packing to blow out, and nothing to deteriorate.

Subaqueous Work: Lines running under rivers or under water work of any kind are easily and economically laid by the use of Universal Pipe. In shallow water the joints can be made up under water if convenient.

Gas Systems: Universal Pipe is particularly advantageous in high and low pressure gas lines, by reason of the tight joint under differences of temperature and its freedom from electrolysis. The close contact of the smooth machined hub and spigot ends makes a joint through which gas cannot escape.

Curved Lines: Straight lengths of Universal Pipe may be laid on a curve of 150 feet radius.

SPECIFICATIONS

Nominal Inside Diameter	Class No. 100 100 Lbs. Pressure			Class No. 130 130 Lbs. Pressure			Class No. 175 175 Lbs. Pressure			Class No. 250 250 Lbs. Pressure			Bolt Sizes
	Approx. Thickness Inches	Estimated Weight Pounds per		Approx. Thickness Inches	Estimated Weight Pounds per		Approx. Thickness Inches	Estimated Weight Pounds per		Approx. Thickness Inches	Estimated Weight Pounds per		
		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth		Foot	6-Ft. L'gth	
2	..	..	..	..	..	..	.35	8½	51	.39	9½	57	½ x 3¾
3	..	..	..	..	..	..	.37	13	78	.42	14½	87	½ x 4½
4	.37	18	108	.40	18½	112½	.43	20½	121½	.45	21½	127½	¾ x 5
5	.40	24	144	.425	25	150	.45	26	156	.49	29	174	¾ x 5½
6	.43	30	180	.45	31	186	.47	32	192	.51	35½	213	¾ x 6
8	.47	44½	267½	.49	46	276	.525	49½	295½	.58	53½	319½	¾ x 6½
10	.50	60½	363	.53	63½	381	.58	67½	406½	.64	74	444	1 x 7½
12	.53	75½	453	.57	80½	483	.62	87	522	.70	97½	585	1 x 8
14	.565	94½	567	.60	99½	597	.66	107½	64	.76	124	741	1½ x 9
16	.60	115½	693	.65	123	738	.72	134	804	.83	156	936	1½ x 9½
20	.67	166	996	.73	178	1068	.82	196	1176	.94	223	1338	1½ x 11½

Lengths lay a full six feet. All pipe tested with a minimum hydrostatic pressure of 300 pounds per square inch.

Special Castings are made with Universal hub and spigot openings, thus avoiding, except in extreme cases, the use of nipples. The lugs upon special castings are in one plane so that the branches or openings will all be in the same plane.



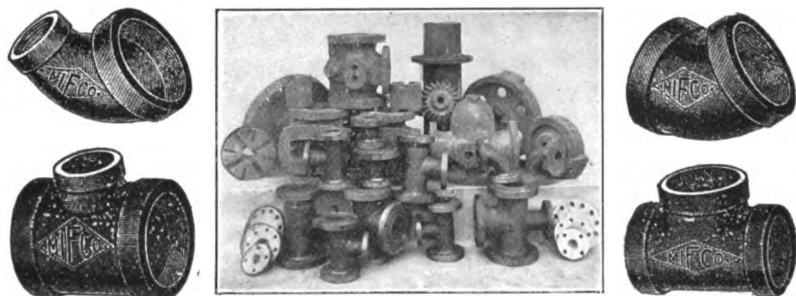
U-165

MALLEABLE IRON FITTINGS CO.

INCORPORATED 1864

BRANFORD, CONN.

Manufacturers of Malleable Iron Pipe Fittings for Gas, Steam and Water; Steel Fittings for High Pressure Service; Air Furnace Refined Malleable Iron and Semi-Steel Castings; Carbon and Alloy Steel Castings



EXTRA HEAVY FLANGES

For High Pressure Requirements

For Rolled, Shrunk or Welded Connection, bored, countersunk, grooved, faced and drilled to specification.

HIGH PRESSURE FITTINGS

Standard Sizes in Stock in Steel or Malleable

Machined, tested and ready for the line.

Specials made to order for railroad, manufacturing, mining, and municipal power plants in compliance with Lloyds Rules or Regulations of the U. S. Steam-boat Inspection Service.

MALLEABLE IRON AND SEMI-STEEL CASTINGS

For Machinery; Automobile; Gun; Sewing-Machine; Overhead, Third-Rail, Underground Electrical Construction and all miscellaneous work.

LOW CARBON STEEL CASTINGS

Better than Open Hearth—Equal to Crucible.

SPECIAL METAL "A"

For Gears and Cams where resistance is wanted. May be heat-treated to required hardness.

AIR FURNACE REFINED VANADIUM IRON

For Piston Heads, Piston Rings, and Cylinders. Has a high tensile strength and is tough, sound, and dense.

CUSTOM AND JOBBING DEPARTMENT

Galvanizing, Tinning, Japanning, Contract Machining of Malleable Iron, Grey Iron, Wrought Iron, and Steel. Galvanized Nails—Marine Hardware.

J. E. LONERGAN CO.

211-215 RACE ST., PHILADELPHIA, PA.

Manufacturers of Boiler, Steam and Gas Engine Specialties



POP SAFETY VALVES

Were first made under Lynde Patents issued in the year 1872, and have since been improved upon by our corps of capable engineers of long experience, who with their combined skill have brought the LONERGAN POP SAFETY VALVE up to its present state of excellence.

Points of superiority:

1. Does perfect work while in service.
2. Repairs practically nothing.
3. Has long life.
4. Always seats perfectly.
5. *Great relieving capacity* as it is the only valve on the market having an expansion chamber above the seat, with baffle plate over that, so as to get the benefit, as the steam lifts the valve off its seat, of both the compressed and expanded steam, which construction gives the valve a high lift.
6. *Adjustable screw ring*, very easy to regulate—used to govern number of pounds steam relieved before valve closes.
7. Springs of the best grade PENNSYLVANIA ANALYSIS OPEN HEARTH STEEL, of a fibre stress suited for best results.
8. All valves made with bevel seats, except when otherwise ordered.

"Protected Spring" Pop Safety Valve

For Water Tube Boilers, etc.



Model "B"

Encased Spring, to protect it from contact with live steam.

LonerGAN Patent Double Eccentric Lifting gear, the best lifting device made.

Good for working pressure up to 300 lb.

Testing yokes furnished at small extra charge.

Fitted for LOCK to prevent their being tampered with.

Recommended for use in Power Stations, Electric Light Plants, Large Manufacturing Plants.

Sizes 2", 2½", 3", 3½", 4", 4½", 5" and 6". Iron Body Bronze Mounted, with either bronze or nickel seats.

"Marine" Pop Safety Valve

For use on Marine Boilers.

General Specifications same as Model "B."

Handle on top allows valve to be turned on its seat when under steam pressure.

Repairs easily made as valve can be broken below outlet, for seat repairs.

Complies with rules of:

United States Board of Supervising Inspectors of Steam Vessels.

Board of Trade, Great Britain.

British Lloyds.

Bureau of Veritas, France.

Sizes 2", 2½", 3", 3½", 4", 4½", 5" and 6". Iron Body Bronze Mounted.



Model "D"

WATER RELIEF VALVES: Good for working pressures up to 300 lbs. Recommended for use on Pumps, Hydraulic Elevators, Pipe Lines, Water Works, etc. Relieving capacity unequaled by any other make of valve on the market.

We also manufacture Cylinder Relief Valves, Chime Whistles, Plain Whistles, Quick Closing Water Gauges, Automatic Closing Water Gauges, Chain Pull Gauge Cocks, Oil Cups, Grease Cups, Jelco G. G. Cutters.

JULIAN D'ESTE COMPANY

26 CANAL ST., BOSTON, MASS.

Brass Founders, Finishers and Machinists. Sole Manufacturers of Curtis Engineering Specialties

PRODUCTS: Damper Regulators, Improved Pressure Regulators, Improved Pump Regulators, Water Pressure Regulators, Expansion Trap, Return Steam Trap, Balanced Steam Trap, Relief Valve for Steam and Water, Steam Separator, Temperature Regulator, Pump Governor and Pump, Blower Valve, Cellar Drainer, U. S. Ball Cock, Etc.

THE CURTIS IMPROVED (PATENT) DAMPER REGULATORS

The plunger is operated by steam direct from the boiler, and the whole pressure in the boiler is therefore available to operate the damper if needed. In practice, only enough pressure is used to lift the weight, usually not more than ten pounds to the square inch on the plunger.

The motion of the damper will begin to change from one direction to the other on a variation of steam pressure of one-half of a pound either way from the point at which it is set to operate.

We guarantee a saving of ten per cent of the fuel over the best hand regulation or the old style (diaphragm and lever regulator), and it often reaches fifteen per cent.



Damper Regulator

They are sent on thirty days' approval and will pay their cost by the saving of fuel in one year. Three Standard Sizes.

IMPROVED STEAM PRESSURE REGULATORS

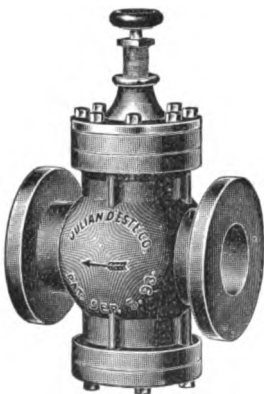
This regulator is made entirely of metal, occupies the same space as a globe valve for the same size pipe, and is very simple and sensitive.

By its use steam may be maintained at high pressure in boilers, and yet be reduced for heating to two or three pounds.

In the best engineering practice the exhaust steam of the engine and elevator is turned into the heating system of a building, and the Regulator automatically supplies just the amount lacking to maintain constant pressure in the pipes and radiators.

Standard sizes for $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, 4, 5, 6, 7, 8, 10, 12, 14, and 16 inch pipe.

A lockup top furnished at small additional cost.

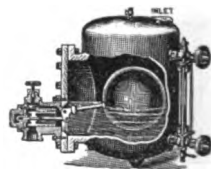


Steam Pressure Regulator

THE CURTIS BALANCED STEAM TRAP

Some Points of Superiority

1. A perfectly balanced valve.
2. An absolutely frictionless valve.
3. The valve can be removed without breaking a joint, starting a gasket, or taking out a bolt.
4. The valve being frictionless and balanced, the whole power of the float is available for opening and closing it.
5. The copper float is perfectly spherical, as hermetically sealed as a glass globe, is of uniform thickness and warranted strong and tight at 250 lbs. pressure.
6. It has a pass-by valve to insure constant operation.
7. Each trap will operate perfectly on pressures varying from one to 250 pounds.



Balanced Steam Trap

PRICE LIST

Size and Condensing Capacity in Feet of One-Inch Pipe			
No. 000,	\$15.00 for	1,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 00,	20.00 for	2,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 0,	25.00 for	3,000 feet	$\frac{1}{2}$ in. inlet and outlet
No. 1,	30.00 for	5,000 feet	$\frac{3}{4}$ in. inlet and outlet
No. 2,	40.00 for	8,000 feet	1 in. inlet and outlet
No. $2\frac{1}{2}$,	55.00 for	15,000 feet	$1\frac{1}{2}$ in. inlet and outlet
No. 3,	75.00 for	30,000 feet	$1\frac{1}{2}$ in. inlet and outlet
No. 4,	100.00 for	40,000 feet	2 in. inlet and outlet
No. 5,	125.00 for	60,000 feet	3 in. inlet and outlet

FOSTER ENGINEERING CO.

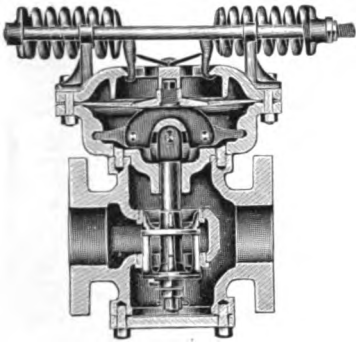
NEWARK, N. J.

BRANCH OFFICES: CHICAGO, PHILADELPHIA, BOSTON, PITTSBURGH

Manufacturing Engineers of Automatic Valve Specialties

PRODUCTS: PRESSURE REGULATORS (Reducing Valves), PUMP GOVERNORS (different styles for different purposes), for steam, water, gas and air. HYDRAULIC REGULATING and RELIEF VALVES, for high and low pressures. Automatic FREE EXHAUST or RELIEF VALVES; BACK PRESSURE VALVES; FAN ENGINE REGULATORS, for controlling speed of fan by pressure in boiler. LEVER BALANCED VALVES; FLOAT VALVES, auxiliary-operated and direct-connected. AUTOMATIC NON-RETURN STOP VALVES; AUTOMATIC NON-RETURN EMERGENCY STOP VALVES, for saturated and superheated steam—semi-steel and cast-steel bodies, and other kindred devices. Over 60 different styles. Also design valves for special services.

FOSTER PRESSURE REGULATOR—CLASS "W"



For Maintaining a Constant Uniform Delivery Pressure from a Higher Initial Regardless of Variations in the Boiler Pressure or Source of Supply. For Service on Steam, Water, Gas and Air.

Its "compensating spring and toggle lever arrangement" makes it phenomenally sensitive, accurate and reliable. Has no weights, levers, or close-fitting piston or parts to cause friction. Very simple in construction and adjustment. Made in sizes $\frac{1}{2}$ -inch to 1-inch of composition, larger sizes, iron body, composition mounted. Sizes $2\frac{1}{2}$ -inch and up are fitted with *renewable seats*, forged steel stem and levers—insuring **durability** and **minimum repairs**. Thousands are in use today in all civilized countries and is the "standard" of many large power and manufacturing plants.

109

FOSTER CLASS "G" PRESSURE REGULATING VALVE FOR INTERMITTENT SERVICE

A decided innovation, so extremely sensitive and withal so reliable that delivery pressure may be adjusted from zero to within a fraction of the initial pressure, and at point of adjustment the delivery will remain constant regardless of variation in initial pressure or volume of discharge.

Will operate equally well on horizontal or vertical pipe; upright, inverted or inclined at any angle.

Although of wide range of operation, no part of this valve is of delicate construction or easily deranged.

Orders should state initial and delivery pressures, connections, service and approximate volume of discharge. (See below.)

Made in all sizes, $\frac{1}{2}$ -inch to 12-inch. Sizes 2-inch and smaller of composition only. Larger sizes, iron body, composition trimmed. Screwed and flanged connections. Also make larger sizes in composition on order only.

Prices on application. Write for General Catalogue No. 20.



ORDERS FOR PRESSURE REGULATING VALVES SHOULD SPECIFY:

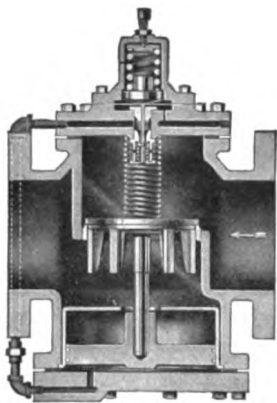
1. Initial or boiler pressure.
2. Maximum and minimum delivery pressure.
3. Connections—screwed or flanged ends, giving diameter.
4. Sizes of both pipes leading to and from regulator.
5. Device or system to which it is to be applied.
6. For high or low pressure service.
7. Size of valve preferred and if we will be permitted to send a smaller size if we deem a smaller valve will give better results. By following our suggestions we often save considerable money for our users.
8. Any additional information towards an intelligent understanding of your requirements will insure your receiving a valve best suited to meet conditions.

KIELEY AND MUELLER, INC.

34 WEST 13TH ST., NEW YORK CITY

Manufacturers of a Complete Line of High Grade Steam, Water and Air Specialties for Modern Heating, Power and Plumbing Installations

KIELEY HIGH PRESSURE PILOT REDUCING VALVE



No. 154

Service—For regulating and controlling steam pressures for any and all services, where close regulation is required. They are especially suitable for marine service, where it is necessary to reduce high steam pressures for operating donkey engines, steering and hoisting engines, high speed electric generator engines, heating systems or other steam appliances used in connection with steam boats or power plant work.

Regulation—Valve will positively respond to the slightest variation in pressure, and will absolutely maintain the pressure at which it is set, regardless of what variation takes place in the initial pressure.

To increase the pressure on the reduced side of the valve, turn adjusting screw on top of valve down, and to reduce the pressure, back up on adjusting screw.

When these valves are in actual operation their control is absolute and perfect.

Working Pressures—Initial pressures, 250 lbs. or less. Minimum delivery or reduced pressure, 10 lbs. Maximum reduced pressure 90 per cent of the initial pressure.

Construction—For general use the valve bodies are made of the best quality of cast iron, and interior working parts of government bronze.

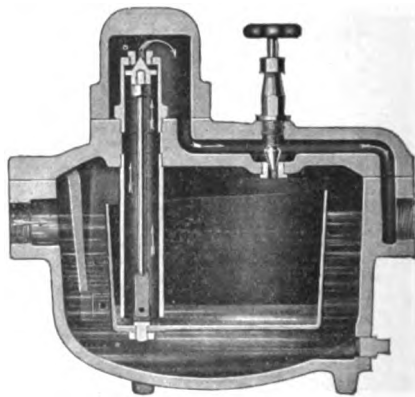
For extra high pressures or superheated steam work we construct the valve bodies of cast iron or cast steel with monel metal or nickel seats and discs. Prices furnished on application.

KIELEY IMPROVED STEAM TRAP

Construction—The Kieley Improved Trap is the latest development in the art of steam trap construction. The important parts and those subjected to the greatest wear are placed high in the top of the trap so that by removing two nuts and the small cap all the parts are accessible and easily removed for repairs. Please note that all of this can be done without having to break any of the pipe connections or remove the cover.

In addition to the above advantages, which are strong points in favor of our traps, we construct the seats and discs of our standard traps of government metal, which is considered the highest grade metal in existence, absolutely non-corrosive, and for excessive high pressure or superheated steam work the seats and discs are constructed of nickel or monel metal, and the bodies of cast iron.

The valves in our traps close off absolutely tight and on account of their being protected by a water seal makes it impossible for any steam to escape from them when in service. This fact alone ought to be sufficient to assure the adoption of our traps in preference to all others, as a leaky trap is one of the most expensive devices you can have in your plant. All parts of our traps are interchangeable and can be obtained at a minimum cost.



No. 702

OTHER PRODUCTS

Reducing Valves for steam, water, air, etc.
Back Pressure Valves for all purposes.
Atmospheric Relief Valves for all purposes.
Steam Traps for all purposes.
Damper Regulators of various kinds.
Hot Water Temperature Controllers.
Steam and Water Separators.
Oil and Grease Extractors.
Pump Regulators.
Water Pressure Regulators.
Water Feeders.
Return Steam Traps.
Feed Water Regulators.
Grease and Oil Traps.

Water Arches.
Emergency Valves.
Low Water Alarms.
High and Low Water Alarms.
Strainer Connections of various kinds.
Drip Tank Controllers.
Float Valves.
Tank Pump Controllers.
Pump Governors and Receivers.
Combination Muffler and Grease Extractor Tank, Receiver, Pump Governor, Pump and Feed Water Heater.
Grease Extractor and Purifier.
Feed Water Heater, etc.

NOTICE—Trade Mark "KIELEY" appears on all our specialties, and they are known by that name. Kindly order or specify accordingly.

NEW COMPLETE CATALOGUE SENT ON REQUEST.

THE LESLIE COMPANY

LYNDHURST, N. J.

**Manufacturers of Pressure Regulators and Other Engineering Specialties
Bronze and Composition Castings**

THE LESLIE PATENT PRESSURE REGULATOR For Steam or Air

Class "E," Bronze.—The Leslie Pressure Regulator, Class "E," is especially designed to deliver any desired pressure from a minimum of about ten pounds up to a maximum of 85 per cent. of the initial or boiler pressure up to 350 pounds per square inch, for all kinds of service, both in Marine and Stationary Service, including Saturated or Superheated Steam, Compressed Air and Oil under pressure to Burners, Journal Bearings, etc.

All Leslie Pressure Regulators, Class "E," are made in standard sizes from $\frac{1}{2}$ inch to 20 inch, inclusive, and are made exclusively of our special high pressure Steam Bronze throughout, except Springs, Bolts, Nuts and Capscrews. The Springs are made of a special steel and are made exclusively for the Leslie Pressure Regulators, and are then specially nickel plated.

Our Class "E" Regulators have met the most exacting and searching tests up to 500 pounds Hydrostatic, and 350 pounds working Steam Pressure, exacted by the United States and Foreign Navies, and in service where all other makes had failed they have proven so successful that they are specified by the leading Naval Architects, Marine Engineers and Mechanical Engineers, as well as the largest users of Reducing Valves in the world, who not only specify them, but insist upon Leslie Valves being installed.

111

Class "F," Iron Body.—Our Class "F" Regulators are designed for Stationary Service where Superheated Steam is not used and where the initial or boiler pressure does not exceed 200 pounds per square inch, and the reduced pressure to be delivered is not less than 10 pounds per square inch.

Similar in design to Class "E," except that it has a Bronze Liner in Cylinder and Bronze Main Valve Seat in Body, and is especially adapted to meet the growing demand for a reliable Reducing Valve in the Stationary Service. The Main Body, Top and Bottom Caps are made of a special high grade Cast Iron, all other parts of high pressure Steam Bronze, same as used in Class "E" Regulators, and are made in standard sizes from 4" to 20", inclusive.

Our Class "F" (Iron Body) Regulators can be found in the largest and most important Power and Steam Plants, Mills, Manufacturing and Mining Plants in this and foreign countries, where they have given results so satisfactory, that we guarantee them to do the work, for which they are intended, satisfactorily to our customers.

Class "H," Steam Heat Service.—Our Class "H" Regulators are designed for Steam Heat Service in Buildings, Compressed Air, Oil under pressure, etc., where the reduced pressure to be delivered is not less than 2 pounds nor more than 10 pounds per square inch.

Made in standard sizes from $\frac{3}{4}$ " to 10", inclusive, from $\frac{3}{4}$ " to 5", inclusive, they are made of the highest grade high pressure steam bronze throughout.

C. A. DUNHAM COMPANY

MARSHALLTOWN, IOWA

No. 1 Madison Ave.
NEW YORK

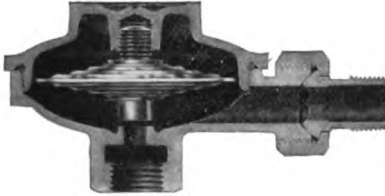
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CHICAGO

611 Wells-Fargo Bldg.
SAN FRANCISCO

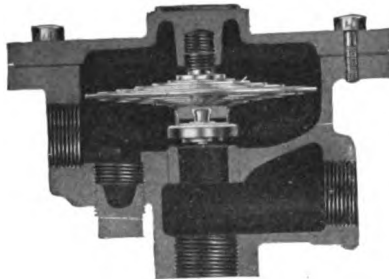
Branches in All Principal Cities

Canadian Factory and Office, C. A. DUNHAM CO., LTD., TORONTO, ONT.

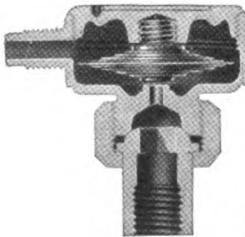
Manufacturers of Dunham Steam Traps, Dunham Packless Inlet Valves, Dunham Air Line Valves, Dunham Reducing Pressure Valves, Dunham Vacuum Pump Governors, and Dunham Systems of Heating



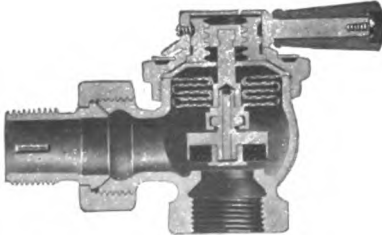
Dunham Radiator Trap



Dunham Blast Trap



Dunham Air Line Service Valve



Dunham Packless Inlet Valve

THE DUNHAM RADIATOR TRAP

for use in connection with the Dunham Vacuum, Dunham Vacuo-Vapor and Dunham Vapor Systems of Steam Heating. It will positively allow for the complete discharge of water and air from the radiator to which it is attached without loss of steam. Constructed of phosphor bronze. This trap is made in three sizes as follows:

No. 1—Up to 100 sq. ft. direct radiation, wt. 1½ lb. pipe connections ½".

No. 2—101 to 350 sq. ft. direct radiation, wt. 2½ lb. pipe connections ½".

No. 3—351 to 450 sq. ft. direct radiation, wt. 3 lb. pipe connections ¾".

The above are made in four patterns, as follows: angle, right hand, left hand and straightway, and are for use on steam pressure up to ten pounds.

THE DUNHAM BLAST TRAP

for use in draining blast coils in vacuum or other steam heating systems. Also for use on large direct radiating units where the Dunham Radiator Trap is too small. Positively opens for water and air and closes against steam. Body made of cast iron.

Care must be taken in reducing blast surface to equivalent direct by multiplying by a factor ranging from 3 to 9, depending upon the temperature, velocity and volume of air being forced over the coils.

Size ¾"—Up to 1500 sq. ft. direct radiation, weight 13 lbs.

Size 1"—1500 to 3000 sq. ft. direct radiation, weight 21 lbs.

THE DUNHAM AIR LINE VALVE

is built upon the same principle as the Dunham Radiator Trap. Is made of cast bronze, nickel plated all over and has union nut and nipple. Made for either ½ inch or ¾ inch pipe connection. Architects and engineers can specify this valve with the positive assurance that it will give the highest class of service, without necessitating the attention that is required to keep the ordinary air line valve in working order. It has been used extensively for revamping old air line jobs where the old air valve has given trouble.

THE DUNHAM PACKLESS INLET VALVE

is really a packless valve. It utilizes a series of diaphragms to allow free up and down movement of the spindle without steam leakage. Requires absolutely no packing or stuffing boxes of any kind. Body made of pure red brass while diaphragms are of a specially compounded metal which offers the greatest resilience and durability. The valve is made only in the angle pattern lever handled type for use on radiators with top connection. The valve is made in ½", ¾", and 1" sizes.

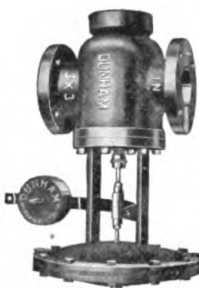
C. A. DUNHAM COMPANY



**Dunham Reducing
Pressure Valve**

THE DUNHAM PRESSURE REDUCING VALVES

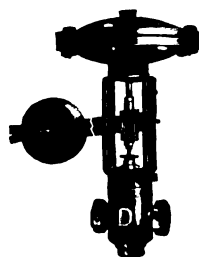
represent the highest quality that can be put into a valve of this kind. It is of the semi-balanced, double-seated type with beveled seats and seat rings ground in and tested for the pressure under which the valve is to operate. All valves are of the inverted type for pressures from atmosphere to 125 lbs. The Dunham Valve is especially sensitive due to the large effective area of the diaphragm. Made in either straight pattern or expanded outlet type, the former being made in all standard sizes from $\frac{3}{4}$ " to 8", while the latter is made in all standard sizes from $1\frac{1}{2}$ " x 3" to 6" x 12".



**Dunham Reducing
Pressure Valve**

THE DUNHAM VACUUM PUMP GOVERNOR

is made for use in regulating the speed of steam driven vacuum pumps enabling them to maintain an even degree of vacuum in the return line. The valve has only one adjustment and any desired vacuum can be produced in the return line by moving the weight on the lever. Made to be installed in a horizontal line of piping. Diaphragm and lever may be swiveled in any direction desired. Made in standard sizes from $\frac{1}{2}$ " to 2".



**Dunham Vacuum
Pump Governor**

113

THE DUNHAM VACUUM SYSTEM OF HEATING

is particularly adapted to large buildings and groups of buildings. The Woolworth building of New York, the Insurance Exchange Building of Chicago, the Pennsylvania State College group and the Louisville Public Hospital are examples of Dunham Vacuum System installation. The Dunham Radiator Trap is the distinguishing feature of this system and is guaranteed to permit free and easy drainage of water of condensation and air from radiators without loss of steam. No jet water is required with this system, due to the fact that the Dunham Radiator Trap does not allow steam to pass into the return piping. The Dunham was the first successful disc type of thermostatic trap. It has been on the market about eleven years, fully six years longer than any other. Anyone contemplating the design or erection of a large building or factory group is invited to investigate this system through tests or inquiries of any sort. Investigation is our very best ally and we welcome it.

THE DUNHAM VAPOR SYSTEM OF HEATING

is the most popular system for heating residences or other buildings where low pressure boilers are preferred and where no pumping equipment is desired. It is a two-pipe system with the Dunham Radiator trap on the return end of radiators the same as in the Dunham Vacuum System. The supply of the radiators is furnished through the Dunham Packless Inlet Valve. Inlet valve always placed at top of radiator and can be opened or closed with three-fourths turn of handle. No back bending or wrist twisting turning as in the case of the old supply valves.

This system is designed not only to furnish easy distribution of heat throughout the rooms, but to regulate that heat as well. All this is accomplished by a combination of the Dunham Pressurestat and Thermostat which direct the movements of an automatic damper motor which operates the boiler dampers as they should be operated. Eliminates pulling up of chains, and need for running up and down stairs. The Dunham boiler room equipment and thermostat does all this janitor work automatically. The system has been on the market for two years and is giving a service that even exceeded our original hopes.

TAYLOR STEAM SPECIALTY CO.

BATTLE CREEK, MICH.

Manufacturers of Power Plant Specialties

PRODUCTS: Boiler Feed Traps, Non-Return Traps, High Duty Vacuum Traps, Three Valve Traps, Cast Iron Exhaust Heads, Galvanized Iron Exhaust Heads, Syphon Heat Circulators, High Pressure Water Circulators.

TAYLOR HIGH PRESSURE WATER CIRCULATOR



This High Pressure Water Circulator will force hot water through the system of piping and give you hot water at faucets all the time. It can be installed either in the flow or return pipe of the hot water tank in a vertical or horizontal position.

Made for belt drive and being light in weight and well balanced it requires no foundation and runs without vibration. It only requires $\frac{1}{4}$ to $\frac{1}{2}$ H. P. to operate, it can be stopped and started at the will of the engineer, it is the only means where your engineer has control over the hot water system.

It will not interfere with the gravity flow when not in use and can be installed at a small expense by any Engineer with pipe tools.

The most economical device to operate and it will save the cost of thousands of gallons of water per month and give you hot water service through the building.

Made in 2" sizes, complete with companion flanges and bolts.

TAYLOR SEPARATING TRAPS (NON-RETURN)

TAYLOR Traps have many distinctly original features making them peculiarly adaptable to severe conditions, where results from other style traps would prove disappointing. All working parts are on the outside, in plain sight, and easily accessible. The tilting of the tank indicates at all times the successful operation of the trap. There is no ball or float inside the receiver and nothing to leak, collapse, rust, corrode or stick.

"Taylor" Separating Traps are perfectly adapted to draining live steam and oil separators, bleeding high or low pressure steam mains, or any other steam apparatus. Sizes from 1,650-108,000 Lineal Ft. Direct Radiation. Guaranteed for 150 pounds pressure.

TAYLOR RETURN TRAP SYSTEM

The "Taylor" Return Trap is a device which receives the water of condensation from whatever source, and automatically delivers it to the boiler or boilers as the case might be, at practically the same temperature due to its pressure at which the steam is condensed. Has the following advantages: LOW first cost, LOW steam consumption when feeding the boiler, practically no expense for upkeep, it will save 90% of the steam it requires to operate a steam pump.

In the construction of our Return Traps we have eliminated all possible strain from the trap receiver, by mounting the balance weight on the frame of the trap, with proper swing connections, connected direct to the EXTRA HEAVY PIPE CONNECTIONS. Sizes from 85,000-200,000 Drainage Capacity in Feet of one inch Pipe Lineal.



Return Trap

TAYLOR HIGH DUTY VACUUM TRAPS

Are designed to drain vacuum oil separators or exhaust steam mains that are under a vacuum. Our traps are doing this work without any danger of impairing the vacuum on the main condenser.

AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

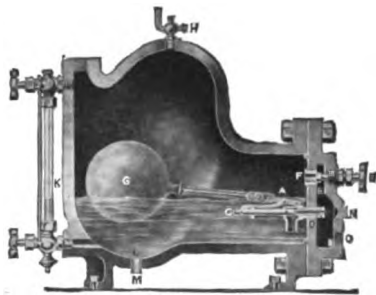
ESTABLISHED 1851

FACTORY AND GENERAL OFFICES, BOSTON, MASS.

AMERICAN IDEAL STEAM TRAP

The essential feature of this Trap is its valve leverage, which is many times more powerful than in any other Float Trap. This permits the use of floats sufficiently heavy to prevent possibility of collapse, and we make positive guarantee to this effect when traps are used on pressures for which they are intended.

Special attention is called to the following table giving rated capacities for pressures 1 lb. to 30 lbs., this rating in every case being under rather than over what the trap will actually do.



Model C—Sectional View

We are also prepared to furnish rated capacities for pressures 30 lbs. to 250 lbs. on application.

The features of construction of this trap, both as regards valve leverage and design of shell or casing, insure unusually low upkeep or maintenance, and absence of trouble in operation.

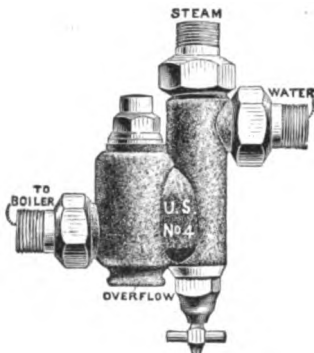
TABLE OF CAPACITIES—MODEL C—LOW PRESSURE

Size Trap		Pounds per Sq. Inch								
		3	5	8	10	13	15	20	25	30
No. 1 Trap ½ in. Opening	Gallons of water....	405	525	670	755	860	925	1,065	1,185	1,300
	Pounds of water....	3,380	4,380	5,600	6,320	7,180	7,730	8,880	9,900	10,880
	Lineal ft. of 1" pipe	6,000	7,780	9,950	11,220	12,750	13,720	15,780	17,600	19,300
	Sq. ft. of rad.....	2,000	2,590	3,320	3,740	4,235	4,570	5,260	5,870	6,430
No. 2 Trap ¾ in. Opening	Gallons of water....	610	795	1,004	1,120	1,287	1,380	1,580	1,770	1,950
	Pounds of water....	5,100	6,640	8,380	9,360	10,750	11,550	13,200	14,800	16,300
	Lineal ft. of 1" pipe	9,050	11,600	14,900	16,650	19,100	20,500	23,470	26,300	29,000
	Sq. ft. of rad.....	3,010	3,870	4,970	5,550	6,375	6,830	7,820	8,770	9,660
No. 3 Trap 1 in. Opening	Gallons of water....	990	1,260	1,623	1,810	2,074	2,230	2,580	2,880	3,150
	Pounds of water....	8,270	10,530	13,550	15,120	17,320	18,600	21,550	24,100	26,300
	Lineal ft. of 1" pipe	14,700	18,740	24,300	26,900	30,750	33,090	38,300	42,800	46,750
	Sq. ft. of rad.....	4,900	6,250	8,100	8,970	10,250	11,000	12,770	14,260	15,580
No. 4 Trap 1½ in. Opening	Gallons of water....	1,520	1,940	2,490	2,800	3,190	3,440	3,970	4,420	4,850
	Pounds of water....	12,700	16,200	20,800	23,400	26,650	28,700	33,150	36,900	40,500
	Lineal ft. of 1" pipe	22,600	28,800	36,900	41,650	47,300	51,000	59,000	65,650	72,000
	Sq. ft. of rad.....	7,530	9,600	12,300	13,880	15,760	17,000	19,660	21,880	24,000
No. 5 Trap 1½ in. Opening	Gallons of water....	2,140	2,800	3,530	3,970	4,525	4,870	5,620	6,270	6,850
	Pounds of water....	17,750	23,400	29,500	33,150	37,800	40,700	47,000	52,300	57,250
	Lineal ft. of 1" pipe	31,550	41,650	52,400	59,000	67,150	72,700	83,500	93,000	102,000
	Sq. ft. of rad.....	10,510	13,880	17,450	19,660	22,380	24,230	27,830	31,000	34,000

AMERICAN INJECTOR COMPANY

DETROIT, MICH.

Manufacturers of Injectors, Ejectors, Jet Pumps, Drive Well Jet Pumps, Exhaust Injectors, Fire Plugs, Grease Cups, Oil Cups, Oil Pumps, Water Gauges, Air Cocks, Gauge Cocks, Lubricating Devices and Other Steam Specialties



U. S. Automatic Injector—Regular Style

U. S. AUTOMATIC INJECTORS

Have the following points of unquestionable superiority:

1. **Easy to Operate**
2. **Wide Range**
3. **Absolutely Automatic**
4. **Never "Break" through Jarring**
5. **Backed by an Absolute Guarantee**
6. **Every Injector Carefully Tested**

The utmost care is taken to see that every U. S. Injector leaving the factory shall be perfect in every respect. Each Injector is tested on different lifts and with various steam pressures. A card is attached to the Injector showing its range, and we guarantee every Injector to work as per attached card.

Other Distinctive Features are: 1. The Drip-Cock. 2. The construction of disk valve on delivery tube, which, being cup shaped, is forced to rise to its seat by the jets of water thrown against it from beneath. 3. The overflow valve, which never wears leaky.

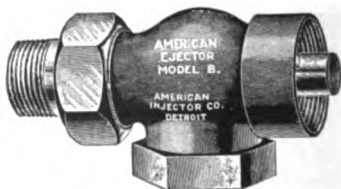
Sizes range from $\frac{1}{4}$ "-3" Pipe Connection, with corresponding capacities of 36 to 5800 lbs. per hour at 80 lbs. steam pressure and three foot lift, water 76 deg.

Special High Steam Injectors to work to 300 lbs. steam pressure can be furnished to order. Also, injectors with special connections.

AMERICAN EJECTORS (Model B)

The American Ejector, because of its internal construction, gives superior service in raising water from deep wells, mines and pits or emptying tanks, raising and transferring liquids (hot or cold) in tanneries, dye houses, etc., or for priming centrifugal pumps.

The jets are made of a special hard bronze and can be renewed when worn, as the body of the Ejector will last indefinitely.



American Ejector—Model B

GAS ENGINE "EXPLOSO" OIL CUP

"Exploso" Gas Engine Oil Cup is especially designed and manufactured for the class of trade demanding a Lubricator of the highest type.

The filling arrangement consists of a sliding lid which makes the filling of the cup very simple and insures it being oil tight. The sight feed opening is large and the shank is fitted with a large ball check valve to prevent back pressure entering the sight feed chamber. A baffle cap is also used which effectually muffles and diffuses any gas that may escape past the ball. With these improved features an even constant flow of oil to the cylinder is insured.

The rate of feed can be adjusted by the milled regulating screw and ratchet holding same to place.

Catalogue No. 28 giving full details about U. S. Automatic Injectors and "The Engineers' Red Book," full of practical information for the Operating Engineer, will be promptly sent upon request.



PENBERTHY INJECTOR CO.

DETROIT, MICH.

N. Y. OFFICE
71 BEEKMAN ST.

LONDON, ENGLAND

BRANCHES:

HANOVER, GERMANY

CANADIAN PLANT
WINDSOR, ONT.

PARIS, FRANCE

Manufacturers of Injectors, Ejectors, Valves, Cellar Drainers, Steam Specialties and Lubricating Devices



AUTOMATIC INJECTORS

850,000 in Use



Automatic Injector

All our claims for the "Penberthy" Injector are based on actual tests, as we have set for this machine a very high standard, which for years has been steadily advanced, and the "Penberthy" to-day is better than ever before. Every "Penberthy" Injector is carefully tested before leaving the factory, and no machine is allowed to go out that will not work on the following points, while nearly all of them will do much better:

Start Low, 20 to 22 lbs. steam on 3-foot lift.
Work High, 165 to 170 lbs. steam on 3-foot lift.
Lift Water, 20 to 24 feet on 60 to 80 lbs. steam.
Handles Hot Water,
125° to 130° at 60 to 80 lbs. steam.
115° to 120° at 100 lbs. steam.
95° to 104° at 125 lbs. steam.

XL-96 EJECTOR SIPHON OR STEAM JET PUMP

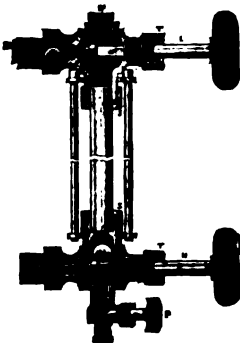


XL-96 Ejector

It would be difficult to enumerate all the uses to which our jet pump is adapted, but when we say that **anything and everything** in the nature of a liquid (if not too thick) can be transported from one level to another, or horizontally almost any distance, we have about covered the ground; therefore the following factories, mills, etc., will see the advantage of adopting them, *viz.:*

Chemical Works, Creameries, Cheese Factories, Tanneries, Mines, Well Diggers, Brickyards, Gas Works, Paper Mills, Steamboats, Breweries, Distilleries, etc.

SAFEGUARD AUTOMATIC WATER GAGE



Safeguard
Automatic Water Gage

Operates on any pressure from 2 pounds up.

Is Tested to 300 pounds and given a thorough examination before being sent out.

Is Constructed simple and strong. There are no springs or levers to get out of adjustment, no unnecessary parts or complications.

Is Self-Cleaning by the action of the blow-off vibrating the balls. The cleaning stem in lower shank goes all the way through into the boiler, absolutely preventing opening from ever being closed by scale, etc. All dirt, deposit, and sediment is forced out through pet-cock each time glass is blown.

Has Patent Dripless Pet-Cock which, when closed, is absolutely tight. The dripless pet-cock is a patented Penberthy feature and is found on no other gage.

Catalog on request.

AMERICAN DISTRICT STEAM CO.

GENERAL OFFICES AND WORKS

NORTH TONAWANDA, N. Y.

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SEATTLE

Engineers and Contractors; "Central Station Heating;" Steam Specialties

CENTRAL STATION HEATING SYSTEMS

Hundreds of Electric Light and Power Companies are selling their EXHAUST STEAM during nine months of the year for heating stores, offices, public buildings, schools, churches, residences, etc.

We will gladly send our representative to investigate *your* conditions and make report.

LIST OF PUBLICATIONS: The following list of publications has been issued by this company upon various phases of central station heating:

Our illustrated pamphlet "Central Station Heating" describes in detail the most desirable public utility—Steam Heat.

- No. 110—Some results of steam heating from a central station.
- No. 111—A live steam heating plant.
- No. 112—An exhaust steam heating plant.
- No. 113—Standard steam pipe casing and wood pipe.
- No. 114—Condensation and pressure meters.
- No. 115—The financial effect of combining an exhaust steam heating system with an electric light and power plant.
- No. 116—The advantages of central station heating to electric companies.
- No. 117—Steam heating in connection with central stations.
- No. 120—Some of the factors that effect the cost of generating and distributing steam for heating.
- No. 121—The developing and application of central station heating.
- No. 122—District heating plants.
- No. 123—Central station heating in Birmingham, Ala.
- No. 124—The value of district steam heating as a public utility.
- No. 125—Central station heating or conserving the heat unit.
- No. 126—Confessions of an engineer.
- No. 128—Central station heating from a commercial standpoint.
- No. 129—Efficiency of underground steam main construction.
- No. 130—The simplex condensation meter.
- No. 131—Central station heating in the smaller cities.
- No. 133—The atmospheric system of steam heating.
- No. 140—Steam heat from a central station. Its use and misuse.
- No. 141—The commercial value of exhaust steam.
- No. 142—How to figure radiation required in a building.
- No. 143—Some phases of central station heating in connection with public utilities.

STEAM SPECIALTIES

Comprising a complete line of materials for underground steam main construction, also meters, steam traps, regulators, heaters, valves, separators, flanged fittings, and "ADSCO" Specialties for the Atmospheric System of Steam Heating.

Write to-day for our bulletins.—They are free.

H. W. JOHNS-MANVILLE CO.

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Asbestos and Magnesia Products and Power Plant Specialties

JOHNS-MANVILLE SERVICE TO POWER PLANTS



There is a distinct advantage in choosing from a line of power plant products on which the responsibility for service and satisfaction is concentrated in one organization, national in scope and reputation.

For in this way you are assured of better service, better value and greater satisfaction all around.

The Mechanical Engineer who uses J-M Products enjoys this advantage in the fullest sense.

Let the nearest Johns-Manville Branch quote you on any of the following J-M Power Plant Products.



J-M Asbestocel Pipe Covering

One of the J-M line of Pipe Insulations

JOHNS-MANVILLE POWER PLANT PRODUCTS

Heat and Cold Insulation

- J-M Asbesto-Sponge Felted Pipe Covering
- J-M Asbestocel Covering and Sheets
- J-M 85% Magnesia Covering
- J-M Asbestos Fire-Felt Covering
- J-M Asbestos Air Cell Covering and Sheets
- J-M Asbestos Moulded Covering and Blocks
- J-M Anti-Sweat Covering
- J-M Aqua Covering
- J-M Zero Covering
- J-M Brine and Ammonia Covering
- J-M Cold Storage Insulation
- J-M Vitribestos Materials
- J-M Magnesia Cement and Blocks
- J-M Sectional Conduit



J-M Sea Rings

An automatic steam, air and hydraulic packing

Power Plant Specialties

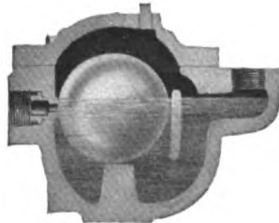
- J-M Steam Trap
- J-M Asbestos Brake Blocks
- J-M High Temperature Cements

Packing

- J-M Flexible Metallic Steam and Water Hose
- J-M Seigelite Packing Sheets
- J-M Kearsarge Gaskets
- J-M Sea Rings
- J-M Metallic Packing
- J-M Universal Piston Packing
- J-M Valve Stem Packing
- NOARK Fuse Materials
- J-M Asbestos Roofing and Siding
- J-M Built-up Roofing
- J-M Fire Extinguisher



J-M Fire Extinguisher
Instantly extinguishes
any type of incipient
blaze



J-M Steam Trap

Only three parts—the body, the rolling ball and the discharge bushing—nothing to get out of order

ARMSTRONG CORK & INSULATION CO.

122 TWENTY-FOURTH ST., PITTSBURGH, PA.

Branch Offices in the Large Cities

Nonpareil Insulating Brick for Boiler Settings, Furnaces, Core, Japanning and Mold Drying Ovens, Waste Gas Mains, Bake Ovens, Kilns, etc.; Nonpareil High Pressure Covering for Steam Lines and Boilers, etc.; Nonpareil Cork Covering for Brine, Ammonia and Ice Water Lines; Nonpareil Corkboard Insulation for Cold Storage Plants

NONPAREIL INSULATING BRICK

Nonpareil Insulating Brick are the most suitable form of insulation yet devised for reducing the loss of heat by radiation from boiler settings, ovens, furnaces, kilns, etc. They have a high heat insulating efficiency, ten times that of fire brick or common brick, are very light in weight, yet sufficiently strong to be built in as an integral part of the structure to be insulated; and are easy to install, being readily cut and shaped.

Nonpareil Brick are made of diatomaceous earth (kieselguhr) and finely ground cork. In the process of manufacture the cork is burned out, giving the brick a peculiar porous structure. They weigh but $1\frac{1}{2}$ pounds each and the size of the standard straight brick is nominally $9 \times 4\frac{1}{2} \times 2\frac{1}{4}$ inches. Standard shapes for arches, circles, etc., are also carried in stock.

While Nonpareil Insulating Brick are not in any sense a refractory material they will withstand temperatures up to 1800° F., without shrinkage or change of form. They can be utilized to advantage to back up fire brick in any place where it is desired to reduce the escape of heat by conduction and radiation. Full size sample brick and literature will be sent on request.

NONPAREIL HIGH PRESSURE COVERING

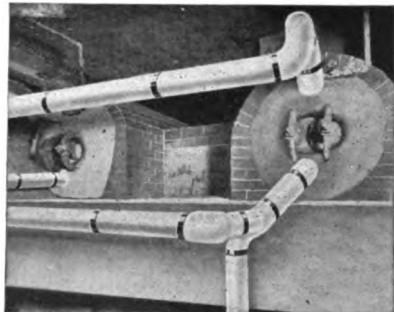
Nonpareil High Pressure Covering is composed of diatomaceous earth and asbestos fibre. Compared with other high pressure coverings, it is not only a better nonconductor of heat, but will withstand much higher temperatures without calcining or disintegrating. It is particularly well suited, therefore, for the insulation of superheated steam lines, feed water heaters, etc. Moreover, it will bear repeated wetting and drying without injury, and for this reason is an ideal form of covering for underground steam lines. It is easy to apply—being furnished in sectional, block and plastic cement form—and so far as price is concerned, will compare favorably with any high-grade covering on the market.

NONPAREIL CORK COVERING

Nonpareil Cork Covering for brine, ammonia and drinking water systems in office buildings, mills, factories, etc., is composed of pure, granulated cork compressed and molded in sectional form to fit the different sizes of pipe and various fittings in ordinary use. Nonpareil Cork Covering is not only more efficient than other coverings when first applied, but remains so because it does not absorb moisture and will, therefore, not mold or rot. It is, moreover, light, clean, neat in appearance and easy to apply. Catalogue and sample on request.

NONPAREIL CORKBOARD

Nonpareil Corkboard is the world's standard cold storage insulation. It is composed of pure granulated cork, made into boards 12×36 inches, of various thicknesses from one to six inches. Descriptive literature and samples on request.



Steam Drums and Top of Boiler Setting Insulated with Nonpareil Insulating Brick. Steam Lines Insulated with Nonpareil High Pressure Covering. Chamber of Commerce Building, Detroit, Michigan

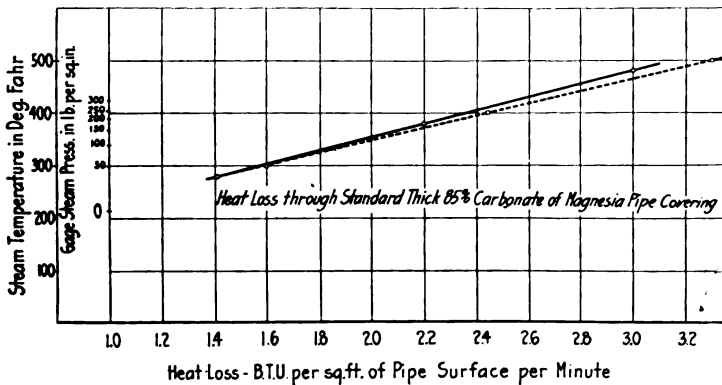
THE PHILIP CAREY CO.
CINCINNATI, O.

THE FRANKLIN MFG. CO.
FRANKLIN, PA.

**THE EHRET MAGNESIA
MFG. CO.**
VALLEY FORGE, PA.

**THE KEASBEY & MATTISON
CO.**
AMBLER, PA.

85% CARBONATE OF MAGNESIA PIPE AND BOILER COVERINGS



121

These curves represent results of tests made thirteen years apart by different men with different sets of apparatus.

They show the heat loss through standard (approximately 1") thick 85% Carbonate of Magnesia Pipe Covering at different steam pressures.

This uniformity of heat insulating value is a characteristic of 85% Carbonate of Magnesia Coverings and means consistent performance.

85% Carbonate of Magnesia Pipe Coverings are standard with the U. S. Navy Department.

85% Carbonate of Magnesia Coverings are standard with leading engineers.

The use of correct insulating materials and correct thicknesses plays an important part in the economical operation of a power plant or heating system. Every engineer should be thoroughly informed upon the subject.

Write for interesting booklet on heat insulation and complete standard specifications giving correct thicknesses of coverings to be used for different conditions of heat and steam pressure. Any of the four manufacturers listed will mail it to you without charge.

A. WYCKOFF & SON CO.

Established 1855

ELMIRA, NEW YORK

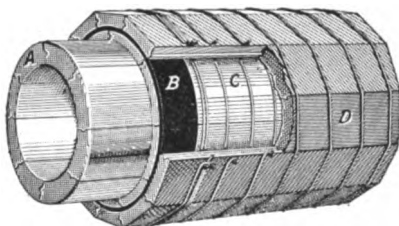
PITTSBURGH OFFICE
Pittsburgh Terminal Warehouse

CHICAGO OFFICE
15th & Jefferson Streets

Manufacturers of Steam Pipe Covering, Wood Water Pipe

WYCKOFF'S IMPROVED STEAM CASING FOR UNDERGROUND OR EXPOSED STEAM LINES

Made of Gulf Cypress, The Wood Eternal



A—2 Inch Thick Inner Shell.

B—Asphaltum Packing.

C—Dead Air Space.

D—1 Inch Thick Outer Shell.

Gulf Cypress is used instead of Pine or Tamarack because Gulf Cypress is the only known wood not affected by Wet or Dry Conditions. The outer shell is one inch thick, the inner shell two inches and the dead air space $\frac{1}{4}$ inch, making the total thickness of the casing $3\frac{1}{4}$ inches. These improvements will more than double the life of former Wyckoff casings. The asphaltum packing and the driven joint make the casing absolutely waterproof.

We make the casing in lengths of from four to eight feet. The lengths are connected by tenon and socket joints. In putting over the pipes it requires simply to be driven together.

This pipe casing is the **ONLY ONE** on the market with

$\frac{1}{4}$ " DEAD AIR SPACE BETWEEN THE SHELLS.

This dead air space between the shells has been increased 50 per cent over the former Wyckoff casing.

Send for our booklet to-day—it tells you all about these improvements.

ALBANY LUBRICATING CO.

ADAM COOK'S SONS, Props.

708-10 WASHINGTON ST., NEW YORK

Manufacturers of Lubricating Oils and Greases

ALBANY GREASE

Is a pure lubricant so compounded that it automatically maintains a film of oil between rubbing surfaces, reducing friction losses to a minimum. It contains no adulterants and is guaranteed not to oxidize, gum or corrode the metal of the bearings. Made in different consistencies to meet different temperature conditions.

You must consider two things when lubricating machinery of any kind. First—Is the lubricant efficient? Does it give perfect satisfaction at all times or only part of the time? Second—Is the lubricant economical? Does it do its work at the lowest possible cost or is it wasteful?

Albany Grease is efficient and economical at all times. It is efficient because it will lubricate any kind of machinery and line shafting perfectly.

It can be used in any kind or style of grease cup and will not gum, cake or clog. It will not corrode, neither will it turn a reddish color, showing that it contains no acids. Albany Grease will remain a golden yellow to the end.

It is economical because it stays where you put it and does not run or leak away. When the machine is not in operation, Albany Grease does not flow. It will flow just enough to give perfect lubrication—no more. These are facts that you should bear in mind when buying a lubricant.

Albany Grease will show wonderful results on Line Shafting and Loose Pulleys, also on Steam, Gas, Gasoline or Oil Engine Main Shaft Bearings, Crank Pins, Eccentrics and Slides. On special machinery, such as Printing Presses, Shoe Machinery, Coal and Metal Mine Equipment, Sugar Machinery, Cotton, Woolen and Paper Mill Installations, Lumber Camp Machinery, Wood Turning, Sawing Machines and in Steel Mills, it gives the best of service. In fact, no matter what kind of machinery you have, Albany Grease will lubricate it so that it will operate perfectly, keeping it cool and easy running, and reducing depreciation to the minimum.

Albany Grease is made in several different consistencies to meet various conditions and temperatures. Use the right consistency for your work and you will have absolutely no trouble.

SOFT NUMBERS (Nos. 0 and 1) for slow running, heavy machinery or where equipment is operated outdoors or low temperature has to be contended with.

MEDIUM NUMBERS (Nos. 2 and 3) for general machinery and shafting; the former is known as a winter grease and the latter as a summer grease. These are the most generally used consistencies.

HARD NUMBERS (Nos. X, XX, XXX) for use in places where the Soft and Medium numbers are not adaptable, especially where the temperature surrounding the bearings is high. The No. XXX has the highest melting point with a great lubricating value.

Due to the wide publicity given Albany Grease, unscrupulous concerns occasionally substitute inferior goods for our product. When purchasing Albany Grease, insist that our trade mark appears on the package.

We also refine and manufacture in addition to Albany Grease, lubricating oils and greases to meet all requirements. No matter what your lubricating proposition may be, we can supply your entire wants. We will be glad to send complete data covering the entire lubrication of your equipment and place at your disposal expert engineering service.



TRADE MARK
Reg. U. S. Pat. Office

THE TEXAS COMPANY

Petroleum and Its Products

HOUSTON

NEW YORK

BOSTON
ATLANTA
NORFOLK
PHILADELPHIA

DALLAS
YOUNGSTOWN
BIRMINGHAM

BRANCH OFFICES

EL PASO
CHICAGO
OKLAHOMA CITY

ST LOUIS
NEW ORLEANS
DENVER

TEXACO CRATER COMPOUND

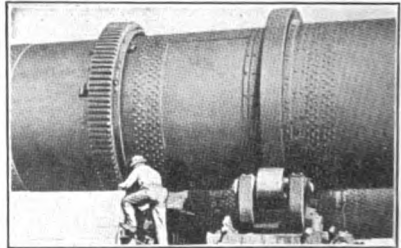
The crying need for an efficient gear lubricant has been felt in many industries for a long time, but this need had never been adequately met before the advent of TEXACO CRATER COMPOUND.

The properties of "CRATER" may be summed up as follows:

1. It adheres to metal surfaces.
2. It is absolutely impervious to mine waters or other chemicals.
3. It is always a lubricant, always oily to the touch.
4. It is pure, homogeneous—as nothing is added to it during manufacture, nothing can separate out in use to destroy its body or to cause it to dry up or flake off.

On the girth gear we have made a particularly fine showing with TEXACO CRATER COMPOUND. The conditions on a gear of this type are unusually severe because of the combination of destructive elements. First, there is the great weight and pressure. Then, it must be remembered that this gear and its pinions are always exposed to the weather. Thirdly, high radiated heat is prevalent due to the temperature of the inside of the kiln—reaching 2800° F.

This is a typical example of the conditions TEXACO CRATER COMPOUND will meet. On your wire ropes and gears, "CRATER" will give you a degree of lubricating efficiency never before reached.



Main Girth Train on Kiln of a Large Cement Plant

OTHER TEXACO LUBRICANTS

In your plant TEXACO LUBRICANTS and TEXACO SERVICE will show the utmost efficiency and economy on engines, dynamos, and machines of all kinds.

The TEXACO Line includes in part:

TEXACO ZENITH VALVE OIL and other cylinder oils, for various steam engine conditions.

TEXACO URSAL OIL for the complete lubrication of Diesel Engines, and for all large internal combustion engines.

TEXACO CETUS OIL for turbines of all makes, and for electrical machinery generally. (A zero cold test oil.)

TEXACO NABOB OIL, TEXACO ALPH OIL, and TEXACO ALTAIR OIL, three very fine general machine oils for light, medium and heavy machines.

TEXACO CANOPUS OIL and TEXACO REGAL OIL for dynamos and high speed engines and machines.

TEXACO RABTEX SPINDLE OIL and a complete line of oils for the textile trade.

TEXACO CUTTING OILS.

TEXACO GREASES for all purposes.

TEXACO ICE MACHINE LUBRICANTS.

TEXACO MOTOR LUBRICANTS, including Texaco Motor Oil, Texaco Grease, and Texaco Transmission Lubricant, all well known for their high excellence.

TEXACO RAILROAD OILS.

A full line of all the best oils for steam and electric railways, and for all marine purposes.



We shall be glad, at all times, to take up any question relating to the use or application of lubricants. Address inquiries to The Texas Company, Department M. E., 17 Battery Place, New York City.



DETROIT LUBRICATOR COMPANY

DETROIT, MICH.

Manufacturers of Lubricators, Force Feed Oilers, Oil and Grease Cups, Air and Gauge Cocks, Priming Cups, Balanced Throttle Valves, Water Gauges, Pop Safety Valve, Fusible Plugs and Radiator Valves

DETROIT SIGHT FEED LUBRICATORS

Detroit Lubricators are made in a sufficient variety of styles and kinds to properly lubricate the valves and cylinders of all types of steam engines, steam pumps, gas engines, air compressors, etc. The complete line includes over 125 styles and sizes of lubricators—one for every kind of service.



Standard Lubricator

IMPROVED STANDARD LUBRICATOR Double Connection

For use on all kinds of steam engines, steam pumps, etc.

Installed with both connections between the boiler and the throttle.

Finished in polished brass or nickel plated.

Size.....	$\frac{1}{8}$ Pt.	$\frac{1}{4}$ Pt.	1 Pt.	1 Qt.	$\frac{1}{2}$ Gal.	1 Gal.
Pipe Thread on Support Arm ...	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$

DETROIT FORCE FEED OILERS

Detroit Force Feed Oilers are designed for the mechanical lubrication of gas and gasoline engines, air compressors, etc. The advantages of this system of lubrication are: cool, clean oil forced by mechanical pressure and in quantities as needed to the proper point to be lubricated, the elimination of the possibility of injury from running dry or carbon deposits, and very little attention from the operator as there is only one tank to fill.

They are made with 1 to 28 feeds and corresponding capacities of 3 to 17½ pints, using a standard tank, 4½" wide and 5" high. Special models for gas tractors, marine and stationary engines, automobiles, commercial trucks and aeronautical motors.



Four Feed Force Feed Oilier

DETROIT LOCOMOTIVE LUBRICATORS

Detroit Locomotive Lubricators are thoroughly suited to fulfill all the requirements of every style of locomotive from the saturated simple engine to the most modern superheated Mallet. The No. 22 Type of Bullseye Lubricators is recommended as possessing improvements and refinements made desirable by the needs of modern locomotive practice, resulting in a low cost of maintenance and economy in oil. Made with from one to eight feeds.



Three Feed Locomotive Lubricator

DETROIT RADIATOR VALVES

Detroit Radiator Valves embody in their design the results of years of experience in the manufacture of all kinds of valves for all styles of heating installation. The Detroit Packless Valve fulfills the need for a radiator valve that will not leak around the stem nor need repacking. Its construction makes it perfectly adapted also for use in vacuum systems where tightness is essential.



Packless Valve

GREENE, TWEED & CO.

109 DUANE ST., NEW YORK

Manufacturers of Rochester Automatic Lubricators, Palmetto and Manhattan Packings, Wrenches, Belt Fasteners, and Other Mill Supply Specialties

ROCHESTER AUTOMATIC LUBRICATORS

For Use on All Types of Steam Engines and Pumps and Air and Ammonia Compressors

In the new POSITIVE CLUTCH DRIVE "ROCHESTER" there are a number of new features which we wish to bring to the attention of all lubricating oil users.

Positive Clutch Drive: When we say "positive" we mean "positive," and this statement we are willing to back up by sending out lubricators on trial. Notwithstanding the fact that the drive is a clutch drive, there is a regulating device, whereby can be caused more or less lost motion of the actuating arm.

Noiseless: Then in the second place the new "drive" is noiseless, which fact recommends its use in many plants where quiet-running high-speed engines need just such noiseless lubricators.

Adapted for High Speed: This new "drive" is just the thing for high-speed engines, one operating at the present time on an engine running at 800 R. P. M. and another having been in operation for over a year on an engine running at 275 R. P. M.

Working Parts Encased: The principal working parts, while easily get-at-able, are encased and so protected from dirt, grit, etc.

Appearance: The appearance of this new type recommends itself to all users.

Automatic Gauge Glass Fixture: If the gauge glass breaks a valve in the lower fixture automatically shuts off the oil and the lubricator keeps on just as though nothing had happened.

SIZES: Made in all sizes from one-half pint to two gallons and with any number of feeds from one to eight. Also made with two compartments, for use where different kinds of oil are used in the different cylinders of the same machine, such as air compressors, ice machines, etc.

Finish—all sizes fully nickel-plated.

Working parts are made of steel, and all bearings are case hardened.

All the mechanism can be almost instantly detached and removed, giving easy access to the working parts for cleaning, repairing, etc., without disturbing the bowl or reservoir attached to the engine.

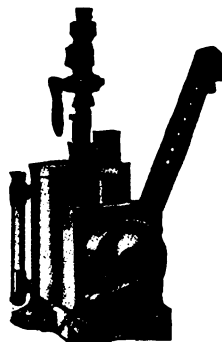
Equipped with Multiplus Sight Feeds, and vacuum and check valves.

Each feed is regulated independently.

Not affected by temperature, pressure, or vacuum.

Can be furnished in the regular ratchet-drive type, if desired.

No expense has been spared in the manufacture of Rochester Automatic Lubricators, efficiency and high quality being our aim rather than low prices.



McCORD MANUFACTURING CO.

DETROIT, MICH.

NEW YORK OFFICE
50 Church St.

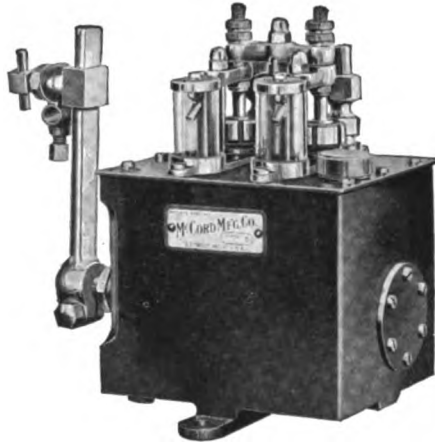
CHICAGO OFFICE
Peoples Gas Bldg.

Manufacturers of Force Feed Lubricators, Gaskets, Automobile Radiators

THE "McCORD" FORCE FEED LUBRICATOR

Is made in from 1 to 14 feeds and has a separate pump for each feed. Each pump has individual adjustment. It has constant sight feeds which show exactly how much oil is being pumped to each bearing and the flow can be adjusted from one drop to a full stream per stroke.

It is positive and automatic in action and operates in perfect synchronism with the engine or pump it is lubricating. It is not affected by viscosity of oil, variations in steam pressure or length of feed lines.



Class B—Two Feed

Note these standard features *and*
Positive sight feeds without pressure
Separate pumps capable of individual adjustment for each feed
Forced delivery of oil against pressure up to 1000 pounds, etc., etc.

These special features.
Heating Chamber
Auxiliary Hand Crank for accelerating feed
Sturdy operating lever
Reversible End Bearing
Plug for draining reservoir

There is positively no pressure in sight feed; all working parts are of the best drop-forged steel and operate in oil. Rotary or Ratchet drive. Finish—full Nickel Plate or Black Enamel and Brass. Straightaway Spring Check Valves. Heating Chamber and Auxiliary Hand Crank furnished as extras when specified.

ALL PRICES F. O. B. DETROIT

No.	Capacity	Feeds	List	No.	Capacity	Feeds	List
1	1 Quart	1 Feed	\$25.00	11	1 Gallon	5 Feed	\$57.00
2	1 Quart	2 Feed	30.00	12	1 Gallon	6 Feed	63.00
3	2 Quarts	1 Feed	28.00	13	1 1/2 Gallons	7 Feed	75.00
4	2 Quarts	2 Feed	35.00	14	1 1/2 Gallons	8 Feed	82.00
5	2 Quarts	3 Feed	42.00	15	1 1/2 Gallons	9 Feed	90.00
6	2 Quarts	4 Feed	49.00	16	1 1/2 Gallons	10 Feed	96.00
7	1 Gallon	1 Feed	33.00	17	2 Gallons	11 Feed	108.00
8	1 Gallon	2 Feed	39.00	18	2 Gallons	12 Feed	115.00
9	1 Gallon	3 Feed	45.00	19	2 Gallons	13 Feed	125.00
10	1 Gallon	4 Feed	51.00	20	2 Gallons	14 Feed	135.00

DOUBLE COMPARTMENT LUBRICATORS FOR AIR COMPRESSORS AND ICE MACHINES

21	2 Quarts	2 Feed		1 Feed in each	\$44.00
22	2 Quarts	3 Feed		2 & 1 Feed in each	50.00
23	2 Quarts	4 Feed		2 Feed in each	57.00
24	1 Gallon	2 Feed		1 Feed in each	47.00
25	1 Gallon	3 Feed		2 & 1 Feed in each	54.00
26	1 Gallon	4 Feed		2 Feed in each	60.00

For Heating Chamber add \$1.00 to list. For Auxiliary Crank add \$1.00 to list.
See Catalog "T" for Details

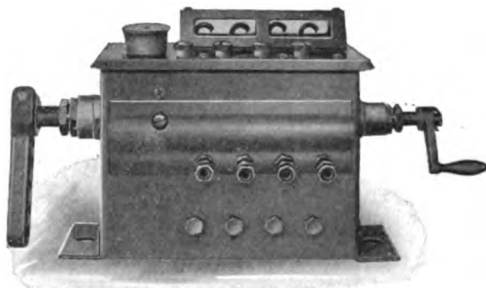
MADISON-KIPP LUBRICATOR CO.

Established in 1898

MADISON, WIS.

Manufacturers of Valveless Force and Sight Feed Mechanical Lubricators

MADISON-KIPP LUBRICATORS



MODEL 50 SIGHT FEED TYPE
Built in any number of feeds

THE PRINCIPLE IS VALVELESS

128

The Madison-Kipp Lubricator has no springs and balls involved in its mechanism. The pumping and forcing is done by ground-hardened steel rotating plungers fitted into ground barrels, all contained in the tank of oil. The ratchet is made of steel with a one-inch face and it is placed inside of the tank running constantly in oil.

PERFORMANCE PERFECT IN ALL TEMPERATURES AND AGAINST ALL PRESSURES

The Kipp no-valve principle makes the lubricator absolutely positive in handling cold or warm oil without change in adjustment. Each lubricator is tested in the factory to force oil against 2000 pounds' pressure. The position of all parts inside of the tank, where they are continuously lubricated, eliminates all wear.

THE SIGHT FEED AND ADJUSTMENT

The sight feed tubes extend above the cover and are protected by a transparent hood, through which can be seen the exact amount of oil being delivered. The adjusting buttons for each feed are placed opposite the tubes, and adjustment can be made down to a fraction of a drop for each stroke of the plunger.

The Madison-Kipp is the original Valveless Mechanical Lubricator. It is built in a standardized factory devoted exclusively to one standard lubricator. The annual production is greater than that of any other mechanical lubricator factory in the world.

THE RICHARDSON-PHENIX CO.

126 RESERVOIR AVE., MILWAUKEE, WIS.

Lubrication Engineers and Manufacturers

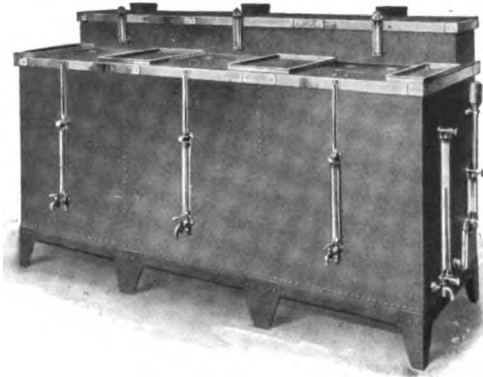
OILING AND FILTERING SYSTEMS FOR POWER PLANTS

AUTOMATIC SYSTEMS FOR CIRCULATING, FILTERING AND STERILIZING CUTTING OILS AND COMPOUNDS

Peterson Power Plant
Oil Filter

Built in Capacities of 100 to
50,000 Gallons per Hour

Described in Catalog S-10



We advise and quote on the necessary material and apparatus, or design and install complete Automatic Cylinder and Bearing Lubrication Systems, in which the oil is regularly and positively supplied in just the proper quantities, and in the case of bearing lubrication, is filtered and used over and over again.

We also design and furnish the necessary apparatus for automatically circulating, filtering and sterilizing cutting oils and compounds.

Our experience in this work, extending over a period of many years, has placed us in possession of valuable data on this subject, and there is hardly a question pertaining to machinery lubrication that we have not met and solved.

We would be pleased to correspond with those interested in automatic lubrication, with a view of explaining our proposition in greater detail.

Our Products Include

The Richardson Model "M" Sight Feed Oil Pump,	Sight Feed Oilers,
The Phenix Mechanical Lubricator,	Gang Oilers,
The Richardson Oil Filter,	Union-Cinch Pipe Fittings,
The Phenix Oil Filter,	Telescopic Oilers,
The Peterson Power Plant Oil Filter,	Oil Pumps,
The Peterson Cutting Oil Filter,	Oil Sinks & Fountains,
Individual Oiling and Filtering Systems,	Sight Flow Indicators,
Central Oiling and Filtering Systems,	Automatic Pump Governors,
Nokut Globe, Angle and Check Valves,	Tank Level Indicators, etc.

Systems for Storing, Measuring and Pumping Gasoline, Lubricating and Paint Oils, Varnishes, Drugs and Kindred Liquids.

Ask for Literature Describing Any of the Above

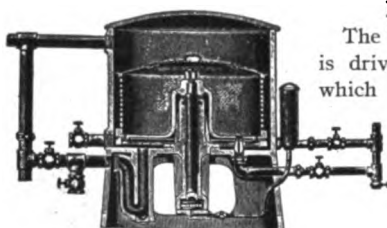
Our plant is the largest one devoted exclusively to the manufacture of lubricating apparatus. We manufacture "EVERYTHING FOR LUBRICATION BUT THE LUBRICANTS."



THE OIL AND WASTE SAVING MACHINE COMPANY

1509 REAL ESTATE TRUST BLDG., PHILADELPHIA

Manufacturers of Machinery for Separating and Reclaiming Oil and Waste, Centrifugal Oil Filters, Oil Extractors for Cleaning Oily Chips



Waste Machine

IMPROVED WASTE MACHINE

The basket or waste receptacle in the machine is driven by direct connected steam turbine, which exhausts into the basket, heating and liquefying the oil and grease, which is extracted from the waste, towels or rags by centrifugal force. The machine is then filled with water, and the waste, towels or rags thoroughly washed and sterilized, after which same is dried by the machine for future use.

Guaranteed saving of 90% of the oil and all of the waste. Requires little attention. Over 3,000 machines in use. Made in 10", 15", 20" and 36" sizes with respective capacities of $\frac{1}{2}$ cu. ft., 1 cu. ft., 2 cu. ft., and 8 cu. ft. of waste rags or machinery towels per charge.

CHIP SEPARATOR

For Extracting Oil from Metal Chips and Small Parts

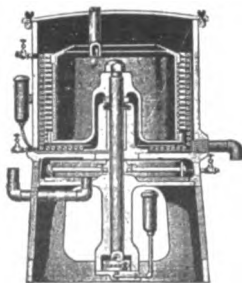
This machine is steam turbine driven, the turbine exhausting so that the heat from the steam comes in contact with the basket containing the oily chips, etc. This liquefies and allows the centrifugal force to thoroughly extract the oils. Built with 24 in. diameter basket, of $3\frac{1}{2}$ cu. ft. capacity, and has steam hoist attached for removing and dumping the basket.



Chip Separator

TURBINE CENTRIFUGAL OIL FILTER

Will remove all foreign matter, all moisture or emulsion from and sterilize the oil. Driven by direct connected steam turbine. The filter requires very little steam to operate same, owing to its design and its being equipped with a ball step-bearing; requires little care in operation and has practically no wearing parts.



Centrifugal Oil Filter

SPECIFICATIONS

Size	15"	20"
Base measurements.....	21" x 21"	27" x 27"
Height.....	30"	40"
Weight.....	450 lbs.	800 lbs.
Steam pressure required to operate...	20 lbs.	40 lbs.
Steam consumed per hour of operation	83 lbs.	138 lbs.
Oil filtering capacity per hour.....	20 to 30 gals.	50 to 60 gals.

THE PICKERING GOVERNOR CO.

PORTLAND, CONNECTICUT

Manufacturers of Governors for Steam Engines and Turbines, Gas Engines, Mechanical Control and Speed Limit

THE PICKERING GOVERNOR

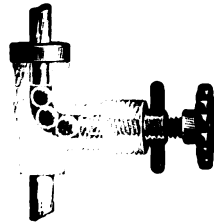
Owing to the absence of joints our Governors are very responsive to slight changes in load, moving quickly and positively into correct position for maintaining the admission of steam proportionate to the duty required of the engine. Absence of joints gives maintenance in efficiency under continued and severe duty.

Greatest range in speed adjustment with close regulation at all points.



Fig. 33

Class B represents Governor with Speed Ronger by use of which the speed of Engine can be varied while in motion. Sawyers' Lever is also included.



Detail of the Speed Ronger

All Governors equipped with Wide Range Speed Changer. U. S. & Foreign Patents.



Fig. 34

Class A, to which is added the Automatic Safety Stop. This Stop closes valve when belt breaks or runs off Pulley, and is simple and certain in its action.

TABLE OF DIMENSIONS, ETC., FOR CLASSES A AND B

Size of Governor Diameter of Opening	1¼	1½	2	2¼	2½	3	3½	4	4½	5	6	7	8	9	10
From cen. of inlet to base	3¼	3½	4¼	4½	5¼	5½	6¼	7¼	7½	8	8¼	9	10	11½	11¾
Extreme Height.....	20¼	23¼	25¼	27¼	27½	32¼	33¼	41¼	41¼	46¼	49¼	49¼	53¼	55¼	60¼
Extreme expan. of Balls	7	8	8	9	9	10	10	13	13	15	16¼	16¼	18	20	20
Speed of Governor.....	350	380	380	300	300	340	340	320	320	275	275	275	260	260	225
Dia. of Pulley on Gov'r.	2½	3½	3½	4	4	4	4	5	5	5	6	7	7	8	8
Di. of Cyl. 300 ft. P'n Sp.	6	7	9	10	12	14	16	18	20	22	26	31	36	40	45
" " 400 " " " "	5	6	8	9	10	12	14	16	18	20	23	27	31	35	39
" " 500 " " " "	4	5	7	8	9	10	12	14	16	18	21	24	28	31	35
" " 600 " " " "	4	4½	6	7	8	9	11	13	15	16	19	22	25	28	32

For complete table and for sizes below 1¼—see our general catalogue.

We build to meet special conditions whenever practicable and are pleased to submit suggestions on request.

PICKERING



TRADE MARK
(REGISTERED)

Pickering is standard for specifications in Steam practice the world over.

We offer our services with over fifty years, successful experience.



THE AMERICAN METAL HOSE CO.

WATERBURY, CONN.

Manufacturers of Flexible Metal Hose and Tubing



Section B. D. 15 Bronze
Steam Hose Showing
Interlocking Joints

AMERICAN METAL HOSE is just what the name implies—a Hose made of metal.

We manufacture Flexible Metal Hose for all the purposes for which rubber hose is used. Its strength and lasting qualities make it the most efficient and economical hose on the market.

While rubber hose gives fairly good results when used in certain easy services such as carrying air and water, in the more severe duties it is unsatisfactory and expensive on account of the frequent replacements necessary. Rubber is a vegetable compound which rapidly deteriorates under the action of Oils, Alkalis and the intense heat of Steam; consequently no hose with rubber in its composition will last any length of time when used to convey any of these agents.

American Metal Hose is made from a continuous strip of high tensile strength Phosphor Bronze or well-galvanized Steel, the edges of which are turned in during the process of manufacture to make the "Interlocking" joints shown in the accompanying illustration. It has the strength of metal combined with great flexibility, and is in no way affected by the heat of Steam or the chemical action of Oils. In addition to the above advantages Metal Hose will successfully withstand very high pressures. We can supply special Metal Hose for pressures up to 6000 lbs. per square inch.

American Metal Hose of the "Interlocking" construction is, from its very nature, a high pressure hose, and is our standard for conveying Steam and Oils. In addition to this Hose, we are making several other types for carrying Air, Water, Gas, etc., and for Vacuum.

Its permanent nature makes American Metal Hose an admirable substitute for swing or telescoping joints and rigid piping on machines where a flexible connection is desired for conveying Steam or Oil. It is particularly adapted to use on presses where a constant supply of Steam must be fed to the moving parts.

We are prepared to furnish Couplings of any description with our Hose. Prices and full particulars on application.



Government Inspector Testing American Metal Hose for the U. S. Navy Department

THE B. F. GOODRICH COMPANY

AKRON, OHIO

Offices in all principal cities

Manufacturers of Mechanical Rubber Goods, Tires, etc.

HOSE

WATER HOSE covers a wide range of usage, making it quite out of the question to advance any specific recommendations as to quality.

"White Anchor," "Akron" and "Commander"—special grades for unusual conditions of service.

"Triton," "Cascade," "Deluge"—regular grades for all general purposes. Braided fabric water hose—in any length up to 500 feet.

STEAM HOSE must be heavily constructed to stand the pressure, and the inner lining must be so compounded as to resist the action of steam under varying temperatures.

"Goodrich"—for high pressure. This is truly a long-life hose.

Special coverings for steam hose: Red Painted Woven Cotton Cover, Coven Marlin Cover, Asbestos Wire-Wrapped Cover.

PNEUMATIC HOSE wrapped duck—50' length style:

"Goodrich"—the highest quality for the hardest service.

"Akron"—the standard hose, for all general purposes.

Wire-wrapped pneumatic tool hose.

Braided Fabric Pneumatic Hose—any length up to 500 feet. "Safety" and "Mainstay" brands.

AIR DRILL HOSE is heavily constructed throughout with a layer of canvas on the outside as a protection against cuts and abrasions.

"Goodrich"—exceptionally high quality, unequalled for wear.

"Quarry"—our standard grade and biggest seller.

BOILER WASHOUT HOSE is made in extra heavy weight to withstand the rough service it encounters. We advocate our heavy "Boiler Washout Hose" for turbine tube cleaner work. Made in three grades, "Goodrich," "Safety" and "Akron."

SUCTION HOSE is made in a variety of grades to suit any purpose, either smooth or rough bore style.

DREDGING SLEEVES, OIL SUCTION HOSE, OIL WELL DRILLERS' HOSE, OIL CONDUCTING HOSE, GASOLINE HOSE, SAND BLAST HOSE, COKE HOSE, MARINE DECK HOSE, all especially adapted to the purposes for which they are made.

PACKING

RED SHEET PACKING—an excellent product, in two grades.

RED SHEET BRASS WIRE INSERTED in the same grades.

DIAPHRAGM AND CLOTH INSERTION: Packing highly recommended for their proper uses.

SUPERHEAT PACKING, a combination of rubber and asbestos, especially adapted for high pressures.

RED TUBULAR GASKET PACKING, SPIRAL SQUARE DUCK PACKING, ROUND AND SQUARE DUCK PACKING, SQUARE RUBBER BACK ROUND PISTON PACKING, AND PURE GUM STRIPS all made to supply the demand for these various kinds.

RUBBER GASKETS

All grades and shapes. No matter what your requirements may be, we can supply them.

"GOODRICH" RUBBER PUMP VALVES

There is no class of our product which we take greater pride in stamping with the Goodrich trade mark. Our list of grades is complete; we are always glad to give special attention to unusual conditions.

Made in grey or red rubber.

MOLDED RUBBER GOODS

We have a large department in our factory devoted exclusively to the manufacture of Molded Rubber articles of every description—Diaphragms, Bumpers, Springs, Cushions, Tips, Balls, Billiard Cushions, Respirators, Rubber Mallets, Soles and Heels, Parts for Automobiles, Truck Wheel Tires, Discs for Steam and Radiator Valves, Special Articles used in connection with the Oil Industry, Sugar Factories, Creameries, Breweries, Laundries, Rubber Parts for Plumbing Devices, Carpet Sweepers, Vacuum Cleaners, etc. A large part of this class of our business lies in the direction of strictly special articles made to customers' specifications, to meet individual requirements. Our product is of uniformly good quality and excellent finish.

**CATALOGUE SECTION
PART II**

**Power Transmission Machinery
Elevating and Conveying Machinery
Hoisting and Transporting
Machinery**

Pages 136 - 196

THE A. & F. BROWN CO.

Established 1854

Incorporated 1898

79 BARCLAY STREET,
NEW YORK CITY

WORKS:
ELIZABETHPORT, N. J.

Engineers, Founders, Machinists and Millwrights. Manufacturers of Gears of all Descriptions, Turned Steel Shafting, Pulleys, Split Pulleys, Friction Clutches, Special Machinery, Etc.

CUT GEARS

These gears are cut on the best up-to-date automatic machines obtainable, enabling this department of the shops to turn out accurately cut gears of every description and size.

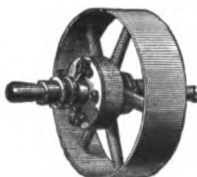
MACHINE MOULDED GEARS

The Gear Department of our foundry is fitted up with the most modern gear moulding machines, enabling us to furnish machine moulded gears up to 16 feet diameter, and 25 tons in weight if in one piece, and heavier if split, or built up. These gears are much more accurate than ordinary cast gears and are of the toughest mixture of iron.



FRICTION CLUTCHES

The F. Brown Friction Clutch is simple, compact and having few small parts is not liable to get out of order; engages gradually and when thrown "in gear" has a stronger grip than any other, owing to the large friction surfaces and powerful operating device which is a combination of double ended (or right and left thread) screw and toggle joint.



SIRENS

These fog signals are used by the United States Navy and Lighthouse Departments, also by a number of foreign governments and many steamships. They are also in use as fire alarm signals in small towns and large manufacturing plants.

COGSWELL MILL

The problem of grinding or pulverizing many materials has been successfully solved by this machine.

SPECIAL MACHINERY

These shops are particularly well equipped for building special machinery to plans and specifications. The pattern shop, foundry and machine shops are strictly up to date in all particulars and equally well equipped to turn out work of the heaviest character as well as light machinery requiring first class material and workmanship and most modern tools.



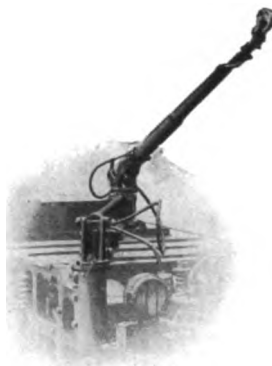
R. D. NUTTALL COMPANY

PITTSBURGH, PA.

Manufacturers of Cut or Planed Gears of Every Description

MACHINE CUT GEARS—COUPLINGS—TROLLEYS

For Every Known Railway, Mining and Industrial Application



**Railway Motor Gears
Haulage Locomotive
Gears and
Forged Steel Pinions**

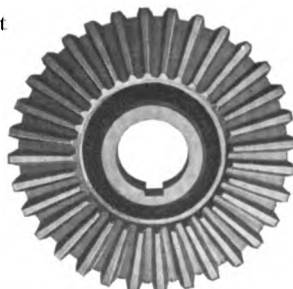


**Forged Steel Gears and Pinions
Oil Tempered or Case Hardened**



Industrial Gears

Spurs up to 60 feet
Bevels 20 feet
Spirals 6 feet
Herringbone 30 feet
Worm Gears 12 feet
Internals 30 feet



Trolleys and Flexible Couplings for Any Service

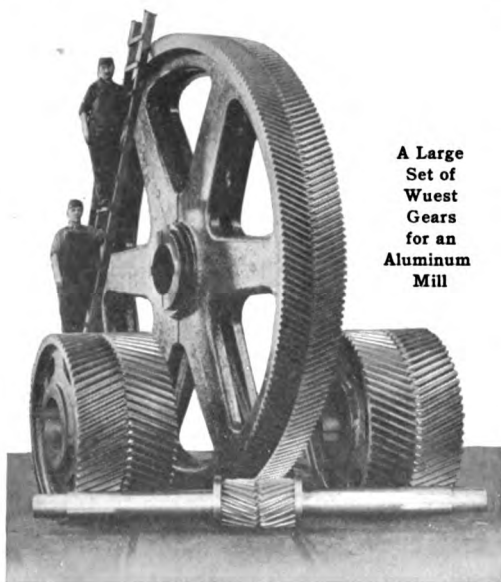
THE FALK COMPANY

MILWAUKEE, WISCONSIN

Manufacturers of Precision Herringbone Gears with Staggered Teeth (Wuest Patents)

WUEST HERRINGBONE GEARS

We manufacture a complete interchangeable system of herringbone gears, with teeth generated on special machines, designed and built exclusively for our own use.



A Large Set of Wuest Gears for an Aluminum Mill

The gears which we produce are hobbled, both sides at once, in solid blanks.

The Wuest System of staggered teeth, besides giving the maximum contact surface for a given width of face, is invaluable in securing unbroken continuity of engagement when using high ratio pinions with very few teeth.

Other distinctive features:—

Highest attainable accuracy.

Involute tooth form on *circumferential* section.

Invariable spiral angle. Perfect interchangeability.

Equal efficiency in both directions.

Fig. 1

SPECIAL ADVANTAGES

Long life.

High efficiency (loss never exceeds 1% at rated load).

Elimination of countershafts and double-gear trains.

Absence of vibration with prevention of shaft crystallization and breakdown of motor insulation.

Quiet action with durable steel pinions.

SIZES

We manufacture hobbled herringbone gears in the following sizes:

Any pitch, from 10 D. P. to $\frac{3}{4}$ D. P.

Any face, from $1\frac{1}{4}$ inches to 72 inches.

Any diameter, from 2 inches to 16 feet.

True spiral gears of constant angle cut to standard diametral pitch like spur gears.

Referring to illustrations, Fig. 1 shows a large set of Wuest gears for an aluminum mill. Fig. 2 shows a high ratio gear unit with 45° spiral angle gears for 3000 H. P. marine turbine drive—U. S. Navy. Fig. 3 is a standard type of herringbone gear unit for motor-driven rolling mills.

THE FALK COMPANY

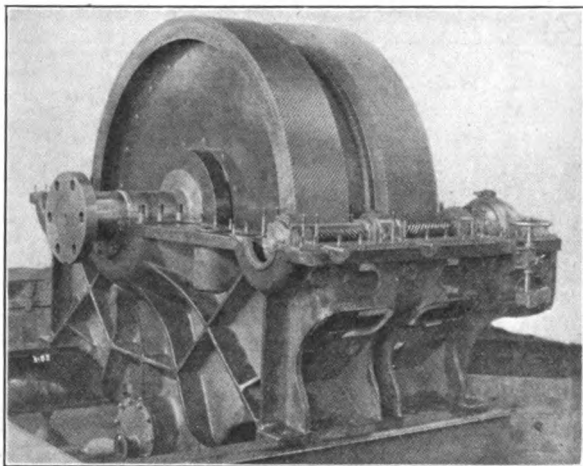


Fig. 2

WUEST HERRINGBONE GEARS transmit power by smooth, continuous action without jar, shock or vibration.

They are almost noiseless.

They can be used for extremely high *single* gear ratios. In this connection we make a specialty of forged pinions in one piece with their shafts. Ratios of 15 to 1 are quite normal and 20 to 1 may be used when necessary. Wuest gears can be run with safety at far higher velocities than the spur type. Special gears for use in connection with steam turbines are suitable for speeds up to 7000 feet per minute.

The range of application for Wuest herringbone gears covers every case where spur gears are used and many new fields where spur gears are impossible.

Specially adapted for
Marine Steam Turbines.
Turbo-Generators.
Turbine-Driven Centrifugal Pumps, Mills and Shafting.
Rolling Mills and Rod Mills.
Tube Mills and Crushing Plant.
Power Pumps.
Air Compressors and Blowers.
Hoisting, Elevating and Conveying Plant.
Rubber Machinery.
Machine Tools.

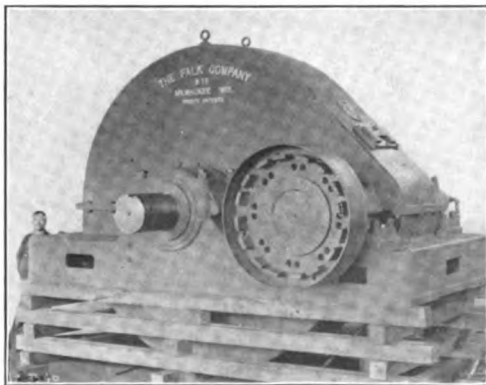


Fig. 3

TURBO-GEAR COMPANY, INC.

BALTIMORE, Md.

Originators of the "Internal Herringbone" Gear



THE TURBO-GEAR (Fast Patents)

Generated on special machine built for our own use.

True involute stub-tooth form, 20° pressure angle.

1. DRIVING AND DRIVEN SHAFT IN ONE LINE.

2. PERFECT LUBRICATION (FORCE FEED).

3. PERFECT BALANCE OF ALL PRESSURES ON SHAFTS.

4. ALL ROTATING PARTS SUPPORTED AT BOTH ENDS DIRECTLY BY CASING.

5. SILENT RUNNING.

6. HIGH EFFICIENCY (98% to 99%).

VERY HIGH RATIOS IN SINGLE TRAIN GEAR. SAME EFFICIENCY FOR SPEED INCREASING AS FOR SPEED REDUCING.

LUBRICATION: The high speed shaft has a central passage through which the oil is pumped and a "*continuous stream*" of oil is sprayed on the gears through radial passages in the pinion.

The high speed bearings beside having "*force feed lubrication*" are provided with "*oil rings*" and a good size oil reservoir for emergency use.

Superfluous oil from the high speed bearings is collected by a centrifugal oil ring and forced through the hollow spindles carrying the intermediate gears, flushing their bearings.

The oil after lubricating bearings and gears is immediately drained to the main reservoir in the base of the housing: here it is strained, cooled, returned to the pump and used over again.

It will thus be seen that the gears "*do not run in oil,*" which causes considerable back pressure at high speeds with corresponding loss in efficiency.

SUITABLE FOR:

Steam Turbines (Land and Marine Service).

Turbo-Blowers (Electric Drive).

Centrifugal Pumps.

Power Pumps.

Air and Ammonia Compressors. Blowers.

Mills.

Line Shafts.

Conveying Machinery.

Elevators (Special Design).

Automobiles (Special Design),

Etc.



External View

THE VAN DORN AND DUTTON CO.

Gear Specialists

THE VAN DORN ELECTRIC TOOL CO.

Electric Tool Specialists

GENERAL OFFICES AND FACTORIES

CLEVELAND, O.

The erection of big new factories equipped with the latest machinery gives both Van Dorn companies excellent facilities for supplying the demand for their respective products.

GEARS AND GEAR CUTTING

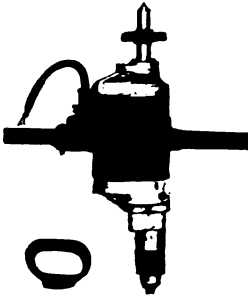
The Van Dorn & Dutton Co. specialize in gearing, and are prepared to furnish complete, machine complete, or cut only—to your specification—gears of all descriptions, for every class of service.

Our output includes spurs, bevels, mitres, spirals, worms, racks, sprockets, rawhide pinions, etc.

An enlarged hardening and steel treating plant is one of the features behind "V. D. & D." Quality.



VAN DORN "HARD SERVICE" (PORTABLE) ELECTRIC DRILLS AND REAMERS



Made in various speeds for rapid production on bridge, structural and car reaming, general drilling, etc.

110-220 and 250 volt machines carried in stock.

The motors employed are of the straight series type, designed to withstand a 50% overload. Ball bearings are used on both ends of the armature shaft, ball type thrust bearings, hardened and ground gears with accurately generated teeth, quick make-and-break switches and forced lubrication in lower head.

DIRECT CURRENT MACHINES

Type	CAPACITY STEEL		Weight	E. H. P.
	Drilling	Reaming		
D. C. 1	$\frac{1}{2}$ "	$\frac{1}{4}$ "	22 lbs.	.73
D. C. 2	$\frac{5}{8}$ "	$\frac{1}{2}$ "	28 "	1.32
D. C. 2x	$\frac{7}{8}$ "	$\frac{3}{4}$ "	38 "	1.47
D. C. 3x	1"	$\frac{1}{2}$ "	40 "	2.07
D. C. 3	$1\frac{1}{4}$ "	$\frac{3}{4}$ "	69 "	2.95
D. C. 4	$1\frac{1}{2}$ "	$1\frac{1}{4}$ "	75 "	2.95
D. C. 5	2"	$1\frac{1}{2}$ "	105 "	4.43

Supplied with cable ready to attach to line. $\frac{1}{2}$ " machines supplied with chucks when wanted. $\frac{5}{8}$ " machines and larger supplied with Morse taper sockets.

We also carry in stock universal machines for operation on D. C. and A. C. in $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{7}{8}$ ", and 1" capacities.

THE AMERICAN PULLEY COMPANY

4200 WISSAHICKON AVE., PHILADELPHIA

BRANCH STORES: NEW YORK BOSTON CHICAGO SEATTLE
33 Greene St. 165 Pearl St. 124 S. Clinton St. 536 First Ave., So.

Wrought Steel Belt and Sash Pulleys and Pressed Steel Sashes



(Patented)
3", 4", 5" and 6" DIAMETERS
Note the sturdy construction. These small pulleys are as perfect in their way as larger "American" Pulleys. No more can be said.



(Patented)
INTERMEDIATE SIZES
Provided with grooved air escape. Six flat "A"-braced arms (edge on) give great rigidity and least air resistance. Riveting the ends of the arms to inner flange means a round pulley, strong where strength is needed.



(Patented)
44" TO 120" DIAMETERS
Grooved air escape. The hub shell is solidly riveted to half an annular hub ring of angle section. Eight arms, bifurcated at the base, are riveted through lapping bifurcations to an annular hub ring.

"AMERICAN"

ALL STEEL SPLIT PULLEYS

Good for Double Belts

The original steel pulleys. Made for twenty years. Nearly 3,000,000 marketed.

These pulleys are correctly designed, and every detail of construction has been carefully studied.

The manufacturers invite experimental tests as to all points of efficiency—belt holding qualities of pulley face, method of crowning, economy as to air fanning, ease of application, high speeds, safety, ultimate strength, etc.

Data has been collected as to each point, and will be furnished on application.

The manufacturers will coöperate with engineers wishing to arrive at the actual facts as to efficiency, putting their testing apparatus at the disposal of inquirers.

"AMERICAN" PULLEYS

All "Americans" above 6" diameter have grooved faces.

Listed sizes 3" to 120".

Crown and straight faces.

Interchangeable Bushings.

No Set Screws, and no Keyways unless for unusually heavy duty.

Stocked by over 200 dealers in the United States and Canada.

All pulleys fully guaranteed.

FALLS CLUTCH & MACHINERY CO.

CUYAHOGA FALLS, OHIO

NEW YORK, N. Y.
206-208 Fulton St.

BRANCHES
BOSTON, MASS.
52-56 Purchase St.

CINCINNATI, O.
134 W. Second St.

Shafting, Pulleys, Hangers, Friction Clutch Pulleys, Friction Clutch Couplings, Pillow Blocks, Couplings, Collars, Heavy Bearings, Base Plates, Floor Stands, Head Shaft Hangers, and all Other Power Transmitting Machinery

FALLS FRICTION CLUTCH PULLEYS AND CLUTCH CUT-OFF COUPLINGS

have been designed by forming a combination of mechanical movements, which are the acme of simplicity and strength, and represent a generation of mechanical research for obtaining the highest possible efficiency, in the saving and distribution of Power.

There is absolutely no contact of frictional surfaces when not in clutch.

They represent a high starting torque. All parts are accessible and easily adjusted, fitted with babbitted or bronze lined sleeves, which are interchangeable. These are held in position by means of cap screws, and, when worn, can easily be removed, rebabbitted and relined, and placed in position without disturbing the pulley on the shaft.



4-Arm Friction Clutch Pulley

FALLS SYSTEM OF ROPE TRANSMISSION



Rope Sheave

The flexibility of Rope Transmission has long been recognized by Engineers as an ideal means of power distribution, which is accomplished by two distinct methods: The English or Multiple System, and the American or Continuous System. The English System is usually preferred on main drives of large units, while the American, or Continuous wrap system operates successfully from small to large loads, and on long or short centers, horizontally, vertically, parallel, or at any angle to each other. On the latter system the use of Tension Carriages is essential to keep a uniform tension at all times on the rope, economy in first cost and maintenance being the initial feature.

We supply complete Equipment, and furnish Competent Engineers to design and estimate for any contemplated installation.

CAST IRON PULLEYS AND PATENT STEEL RIM PULLEYS, either Solid or Split, Single or Double Arm.

HAMMERED FORGINGS for Shafting purposes on larger diameters, and **DRAWN OR TURNED** on smaller sizes.

Complete line of **BEARINGS**, made dust-proof, Self-Oiling, Ring-Oiling, or for Grease Lubrication.

BASE PLATES, HEAD SHAFT HANGERS, AND FLOOR STANDS, suitable for any conditions.



Plain Pulleys



Competent Corps of Engineers at your Service.

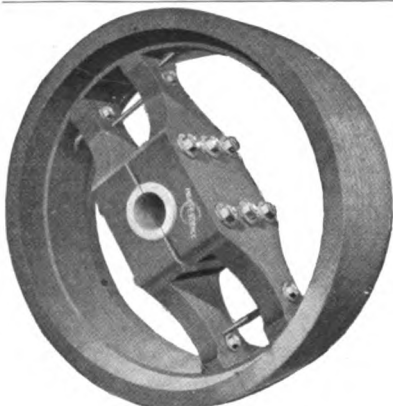
DODGE SALES & ENGINEERING CO.

Distributors of the products of

DODGE MFG. CO., MISHAWAKA, IND.

15 Branch Warehouses in the United States Dealers in Every Representative City

Designers and Builders of Everything for the Mechanical Transmission of Power



"Independence" Wood Split Pulleys are lighter, stronger, steadier, than any other pulleys of their type; they insure the maximum tractive pull of belts and are guaranteed to give satisfactory service.

In these days when "DELIVERY" is considered of equal importance with "QUALITY," there is a double reason for your specifying "Dodge" pulleys.

Dodge pulleys constitute the standard of the world in design, strength, interchangeability, service and prompt delivery.

"Independence" Dodge Wood Split pulleys are 40 per cent to 80 per cent lower in price than any pulley made from any kind of metal.

They will stand up under any double belt service and will run successfully at any practicable speed.

Dodge Wood Split Pulleys are guaranteed. If they fail in any way to satisfactorily perform the function of a stock pulley, they may be returned and full credit will be allowed.

The Dodge "Standard" Iron Split Pulley is America's ideal service pulley. It is easily put up or taken down, and will fit shafting of all regular sizes. There are no rivets to shear or joints to work loose.

The Dodge "Standard" Iron Split Pulley is impervious to the weather, to water, to steam or acid fumes.

The Dodge "Standard" Iron Split Pulley does not become distorted under strain; it is perfectly round and gives a full 100 per cent belt contact.



The Dodge Interchangeable Bushing system makes possible the application of a pulley to any size of shaft within the range of standard bores as follows:

3" diameter	1 1/2" bore
4" diameter	2" bore
5 to 7" diameter	2 7/16" bore
8 to 23" diameter	3" bore
24 to 48" diameter	3 1/2" bore
50 to 72" diameter	4 1/2" bore



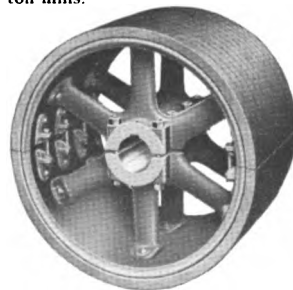
Bushings for Standard Iron Splits are made and finished whole, then cracked, and the fractured edges are dressed away slightly to provide for proper clamping clearance.

Two complete bushings are required for each pulley, one for each end of the pulley hub.

144



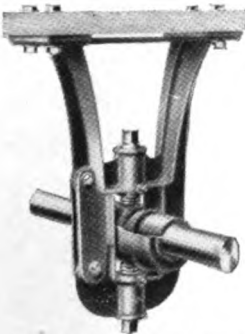
Split Iron center double strength wood rim pulley for heavy service in textile and cotton mills.



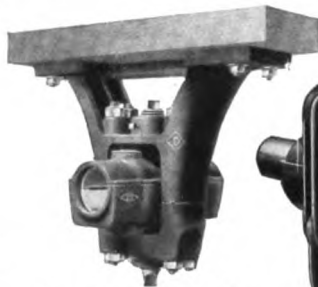
Split Iron center wood rim pulley with double arms especially adapted for use as high speed motor or generator use.



DODGE SALES & ENGINEERING CO.



The Dodge Drop Hanger is ball-and-socket in its fitting.



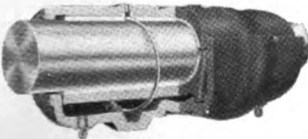
Dodge Heavy head shaft hangers fitted with Ring-oiling bearing. Made in two standard "drops" of 12 and 18 inches.



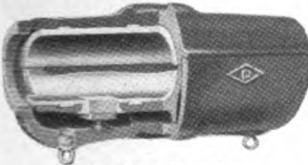
Adjustable Ball-and-Socket Post Hanger with Standard and Self-oiling Bearings. Ample adjustment; machined base.



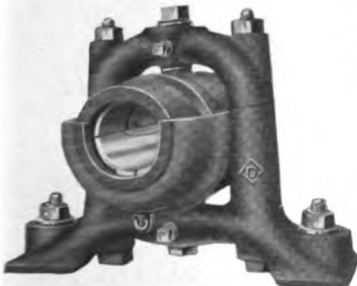
Plain Bearing



Ring Bearing



Capillary Bearing



Adjustable Pillow Block has open frame and ball-and-socket principle. When inverted forms a head shaft hanger.



Capillary and Ring-oiling Rigid Pillow Blocks adapted to the most severe service. May be ordered with dust proof ends.



Common Flat Box for use under conditions where moderate powers are involved and where heavier self-oiling equipment is unnecessary.

For pleasing appearance, ample strength, wide adjustability, easy erection, perfect alignment, and general mechanical quality there has never been produced an equal to the Dodge double brace, ball-and-socket hanger, made on both "drop" and "post" styles.

Designed for the utmost strength in form and proportions, it is nevertheless of pleasing appearance in its lines of symmetry and its distribution of metal. To the mechanical eye, these features are all quite in harmony, each having its share in creating and sustaining an impression of confidence in the general excellence.

Each frame with a given jaw size will receive the hanger boxes for a range of $\frac{1}{8}$ inch of shaft diameters. For example, the "G" frame will accommodate all diameters from $2\frac{1}{16}$ to $2\frac{1}{2}$ inches. All hangers for these shaft sizes have jaws of same dimensions, the various "drop" distance being provided by different lengths of legs. The longer legs naturally give the greater spread and larger feet desirable for the longer drops.

In the new Dodge Book C-16 the subject of hangers and bearings is discussed fully. Correct engineering tables are given as well as suggestions for a wide number of unusual uses of hangers; pillow blocks, floor stands, etc.



"Dodge" Bearing metal is intended for use under all general conditions, the "Copper Hardened" brand being better suited for places where there is considerable vibration, knock or pound to contend with.

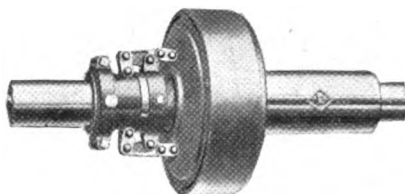
Our "Genuine" brand is intended for use in bearings where heavy crushing strains are involved. We make a brand of metal for every service condition.

(Continued from preceding pages)

DODGE SALES & ENGINEERING CO.

The Dodge Solid Friction Clutch is particularly adapted for countershaft use, and such other places where a solid type of clutch can be advantageously employed, and where the power requirements are within the range of capacities offered in this style of construction.

Any kind of a pulley—wood, iron center wood rim or iron, and either solid or split—or any gear, sprocket or sheave wheel, can be used upon this clutch.



Rated Capacity of Dodge Solid Friction Clutches when Operating at Speeds Shown

Size of Clutch	REVOLUTIONS PER MINUTE										Maximum Speed	Reg. Spec.
	100	150	200	250	300	350	400	450	500			
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.			
4"	1 1/4	1 1/4	2 1/4	3 1/4	3 1/4	4	4 1/4	5	5 1/4	600	1 1/4	
5"	2	3	4	5	5 1/4	6 1/4	7	8	9	750	1 1/4	
6"	3	4	6	7	7 1/4	8 1/4	9	10	11	900	1 1/4	
7"	4	6	8	10	11	12	13	15	16	1050	1 1/4	
8"	5	7	10	12	14	15	17	19	20	1200	1 1/4	
9"	6	9	12	15	17	19	20	22	23	1350	1 1/4	
10"	10	15	20	25	28	31	35	39	40	1500	1 1/4	
12"	15	22	30	37	43	47	51	56	58	1800	1 1/4	4"
14"	20	30	40	50	58	65	72	79	81	2100	1 1/4	5"
16"	30	45	60	75	85	95	105	115	118	2400	1 1/4	6"



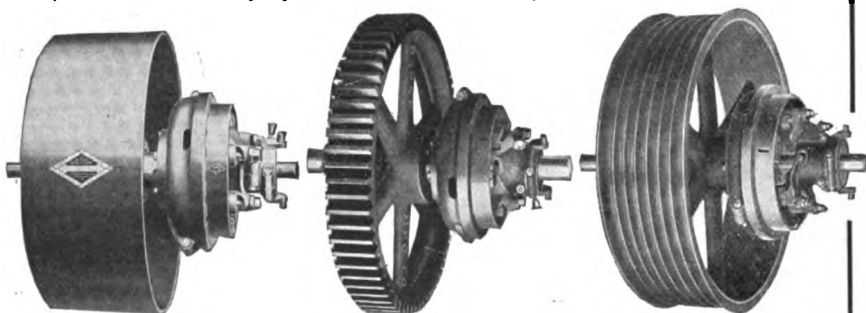
Dodge Patent Split Friction Clutches make possible two things of great importance and value:

(1) The easy and ready installation of the equipment upon a shaft already in place without taking down same, and

(2) The greatest possible facility in the taking off of old parts and the substitution of new, in the event that any repairs or renewals are necessary.

the shaft or disturbing any of the equipment upon

146



Dodge Split Friction Clutch with Dodge Split Iron Pulley.

Dodge Split Friction Clutch with Spur Gear.

Dodge Split Friction Clutch with Rope Sheave.

The Dodge Patent Split Friction Cut-Off Coupling is used for the purpose of connecting together two sections of shafting in such a way that one section can be stopped or started at will while the other section is operated continuously.

The mechanism of the Dodge Patent Split Friction Cut-Off Coupling is the same as is employed with the friction clutch for use with pulleys, gears, sheaves or sprockets. Instead, however, of the extended loose sleeve, a hub part is used, which is keyed to one of the shafts and provides a bronze bushing for receiving the extended part of the other shaft to which is keyed the driving plate of the mechanism.

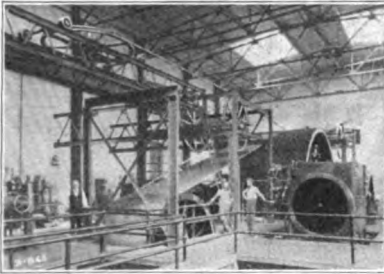
The subject of clutches is an important one and is fully described in the Dodge Book C-16, in addition to other special literature devoted to the subject. It will be sent on request.

Rated Horse Power Capacities of Dodge Split Clutches

Size of Clutch	REVOLUTIONS PER MINUTE								*Maximum Speeds		Maximum Bore
	100	150	200	250	300	350	400		C. I. Sleeves	Bab. Sleeves and Quills	
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.				
10	6	9	12	15	17	19	20	250	450	2 1/4	
12	10	15	20	25	28	31	34	250	440	3	
14	15	22	30	37	47	51	51	250	430	3 1/4	
16	20	30	40	50	63	68	68	250	420	4 1/4	
18	25	37	50	62	71	79	85	250	410	5	
20	32	48	64	80	91	100	109	250	400	6	
22	40	60	80	100	114	126	135	250	390	6 1/2	
24	50	75	100	125	142	157	167	250	380	7	
26	60	90	120	150	170	188	200	250	370	7 1/2	
28	70	105	140	175	200	220	235	250	360	8	
30	80	120	160	200	225	250	265	250	350	8 1/2	
32	90	135	180	225	255	280	295	250	340	9	
34	100	150	200	250	280	310	325	250	330	9 1/2	
36	110	165	220	275	310	340	355	250	320	10	
38	120	180	240	300	340	375	390	250	310	10 1/2	
40	130	195	260	325	370	410	425	250	300	11	
42	140	210	280	350	400	440	455	250	290	11 1/2	
44	150	225	300	375	425	470	485	250	280	12	
46	160	240	320	400	450	500	515	250	270	12 1/2	
48	170	255	340	425	475	525	540	250	260	13	
50	180	270	360	450	500	550	565	250	250	13 1/2	

to other special literature devoted to the subject.

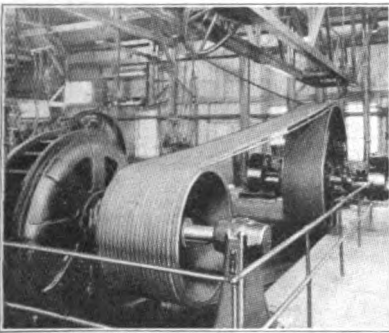
DODGE SALES & ENGINEERING CO.



range of service conditions. The English system is occasionally used on certain large drives where the conditions are proper for that system.

The advantages of transmitting power by means of rope are:

1. Distance and direction in which power is transmitted are practically unlimited.
2. Transmission of any amount of power.
3. Economy in first cost and maintenance.
4. Economy of space.
5. Positive drive, smooth running, and noiseless.
6. No electrical disturbance or loss of power by slipping.
7. Ease and simplicity of distributing power to the several floors of mill buildings, or from one building to another.

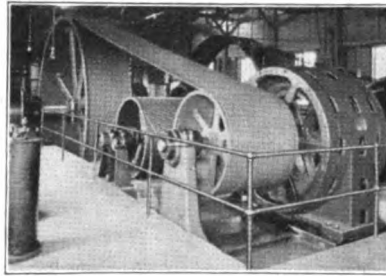


There are now in use two so-called systems of Manila rope driving—the Dodge American, or continuous rope system, and the English, or Multiple rope system.

The Dodge American System uses but one continuous rope, winding over all of the grooves, with the rope on the slack side forming a loop over an idler sheave and a traveling tightener, the tightener being controlled by a weight, so that it may automatically regulate the tension of all the wraps of rope.

The English system uses separate and independent endless ropes in each groove of the wheel, depending on the weight of the ropes for tension, and pinched grooves for adhesion.

The Dodge American System is the one now most universally employed because of its much greater adaptability for a wide



8. While it is important that in the original design of a rope drive all the details should have the attention of an experienced engineer who has specialized on that class of work, the equipment can be successfully operated and maintained by any mechanic of ordinary ability.

9. Precise alignment of shafting not necessary.

10. Lack of that extreme rigidity found in gear drives.

11. In its operation there is present that inertia, or what might be termed fly-wheel effect, which will ease off the peak and shock loads, a particularly valuable feature when motors are involved.

It is not possible to cover here in a complete manner the general subject of rope driving. We issue, therefore, special catalogues devoted to this method of transmitting power, which catalogues will be sent upon request.

Horsepower Capacities of Dodge American System of Rope Transmission
Horsepower of One Rope Based on an Arc of Contact of 180°

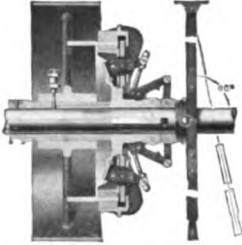
Rope Diameter	ROPE SPEED IN FEET PER MINUTE										
	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	55
$\frac{3}{8}$	1.5	3.0	4.5	5.8	7.1	8.1	9.0	9.7	10.2	10.4	10.3
$\frac{7}{16}$	2.1	4.1	6.1	8.0	9.7	11.3	12.6	13.7	14.6	15.1	15.2
1	2.7	5.4	8.0	10.5	12.8	14.9	16.8	18.4	19.7	20.6	21.1
$1\frac{1}{8}$	3.4	6.8	10.2	13.3	16.3	19.1	21.6	23.8	25.6	27.0	28.0
$1\frac{3}{8}$	4.3	8.5	12.6	16.5	20.3	23.8	27.0	29.8	32.3	34.3	35.8
$1\frac{5}{8}$	5.2	10.2	15.2	20.0	24.6	29.0	33.0	36.6	39.7	42.4	44.6
$1\frac{7}{8}$	6.4	12.2	18.4	23.9	29.4	34.6	39.5	43.9	47.9	51.3	54.1
$1\frac{9}{8}$	8.3	16.6	24.7	32.7	40.3	47.6	54.5	60.8	66.7	71.9	76.4

THE HILL CLUTCH CO.

CLEVELAND, OHIO

NEW YORK SALES OFFICE, 50 CHURCH STREET

A Complete Line of Power Transmission Machinery for Belt and Rope Drive, Including the Patented Hill Friction Clutch (Smith Type) and Collar Oiling Bearings



Sectional View Hill Clutch Pulley

(Smith Type)—(Patented)

Built solid or split in sizes from 9 to 1300 H. P. at 100 R. P. M.

HILL FRICTION CLUTCHES

(Smith Type)

The improved Smith Type Hill Clutch is the latest development of the well-known Hill clutch which we have successfully manufactured for the past 32 years. Vise-like jaws grip the ring in pairs, actuated by a powerful toggle mechanism. No springs. Clutch is self-centering, and in a cut-off coupling no alignment bushing is required, so when clutch is disengaged there are no parts in contact, therefore no wear.

In specifying Hill friction clutches call for the improved Smith Type to insure your obtaining the latest design, and a clutch of great mechanical stability and large starting power—two essential features in friction clutch design.

HILL COLLAR OILING BEARINGS

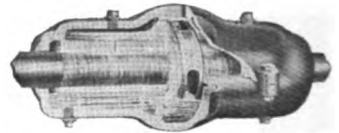
In the Hill Collar Oiling Bearing, instead of depending upon a loose ring or chain for conveying oil to journal, a fixed collar is employed thus providing a positive means of elevating the oil that never fails.

In the Cleveland Type Collar Oiling Bearing oil stored in a reservoir in the bottom of the bearing is continuously elevated by a heavy split collar. Metal wipers deflect the oil which is then distributed along the full length of the journal.

In the Standard Type Collar Oiling Bearing the oil is elevated to an upper reservoir by means of a similar heavy split collar, clamped to the shaft. From the upper reservoir the oil flows by gravity over the entire bearing surface.



Sectional View Hill Collar Oiling Bearing Cleveland Type, Patented



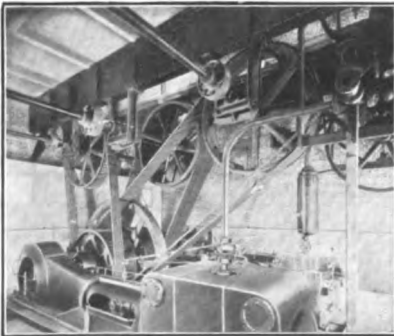
Sectional View Hill Collar Oiling Bearing Standard Type

HILL ROPE DRIVES

American and English System Rope Drives, designed, built and installed.

Our twenty-five years' experience enables us to recommend the best method of installing each individual drive to meet customers' requirements.

Preliminary information furnished free of charge to all contemplating new drives or changes in their present system.



Installation of Hill American System Rope Drive

THE MOORE & WHITE CO.

ESTABLISHED 1885

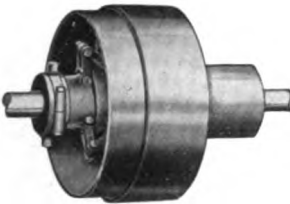
PHILADELPHIA, U. S. A.

Manufacturers of Friction Clutches and Variable Speed Changes

MOORE & WHITE FRICTION CLUTCHES

FRICTION CLUTCH PULLEYS

FRICTION CLUTCH CUT-OFF COUPLINGS



**Friction Clutch Cut-Off
Coupling**

As a result of thirty-one years' experience in building Friction Clutches for all kinds of work, we are now prepared to supply High Speed Friction Clutches to meet all requirements for this class of service.

The Moore & White High Speed Friction Clutches were designed primarily to fill the demand that has long existed for a Clutch that would stand up well under long, hard service and at the same time transmit great horse power at moderately high speed, although these Clutches can be made to run at speeds up to 2500 R. P. M.

The "Safety First" feature has been well taken care of. All moving parts are self-contained and free from dust or any foreign substance. The parts are few in number and are interchangeable. Expert mechanical knowledge is unnecessary to understand the principles of adjustment and operation. It is impossible to adjust these Clutches so as to give an uneven frictional contact surface. Each Clutch is sold with an absolute guarantee for satisfactory service or money refunded.

Send for FREE Catalog D with complete description.

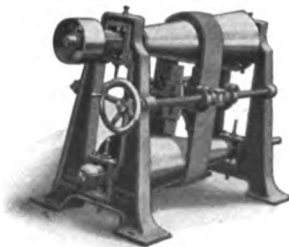
MOORE & WHITE VARIABLE SPEED CHANGES

Arranged to give any desired variation, without stopping the machine. This is made possible by means of a shifter, operated either by hand wheel or chain wheel. These Speed Changes dispense with friction and waste of power; there is absolutely no end thrust or wear on belt.

Any horse power from 1 to 200.

These Speed Changes are theoretically and mechanically correct and are built in a very substantial manner.

Built vertically or horizontally, or can be attached to motor. We build special Speed Changes for Variable Speed Engines.



No. 5 Speed Change

Booklet D FREE upon request.



T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Manufacturing Engineers, Power Transmission Machinery



Showing Different Forms of Keyseats

SHAFTING

Our shafting is made of the best steel and is perfectly round and straight, qualities that insure easy running and also minimum loss of power. We are prepared to furnish shafting in diameters up to 24 inches.

SAFETY SET COLLARS

These are made in either solid or split for all sizes of shafting, are finished all over and fitted with hardened set screws. From the illustration it will be noticed that all bolts and set screws are protected by side flanges projecting beyond heads and nuts.



Safety Set Collar

We also supply Concealed Fast Collars; these are forged from bar steel bored slightly undersize and shrunk on shaft. The turning and finishing is done after the forging is shrunk to place, thereby insuring a true running collar.

COUPLINGS

This line consists of Flange or Plate Couplings in either the Male and Female Type or Standard Plain Face Type; Double Cone Compression Couplings; Improved Collins Compression Couplings; Universal Giant Compression, the coupling that requires no keys; Ribbed Compression Couplings; Ring Compression Couplings; Shifting Jaw Clutch Couplings; Solid Sleeve Couplings and Universal Joint Couplings.



Universal Giant Compression Coupling



HANGERS

While we have adopted the Ring Oiling Bearing as the standard for our Hangers, we can supply Plain Bearing with Grease Cups and the Chain Oiling Type. The Ring Oiling method is also embodied in our Double Collar End. Recessed Pattern for Concealed Fast Collar, and Closed End Bearings. Our extensive line of Hangers includes Regular and Extra Heavy Ball and Socket for Headshafts; Double Brace Adjustable Ball and Socket Regular and Post Patterns; Bracket; Peerless Adjustable, Post and Pillow Blocks. Adjustable Girder Clamps and Countershafts should also be mentioned here.



Hanger

PILLOW BLOCKS, ETC.

This classification covers Solid and Split Vertical Shaft Bearing and Adjustable Step Bearings; Plain, Rigid, Rigid Quill, Extra Heavy and Standard Rigid, Pillow Blocks; Plain Flat Boxes, Solid Journal Boxes and Standard Rigid Post Boxes; Plain, Wick and Ring Oiling, Cast Iron and Steel Arch Wall Frames; Base Plates; Cast Iron Wall Brackets; Plain, Ball and Socket and Extra Heavy Ball and Socket Floor Stands; also Fire Wall Sleeves.



Pillow Block

T. B. WOOD'S SONS COMPANY

PULLEYS

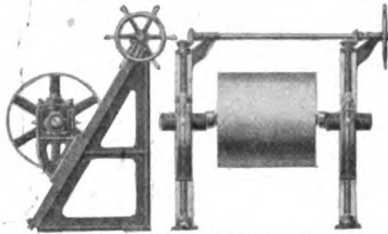
We manufacture Cast Iron Pulleys only, believing that they are superior to others because they are permanent and are suited to a wider range of service than any other type of pulley. The line comprises Plain, Split, Large Bore, Clamp Hub, Tight and Loose, Fly Wheels, Split Arm, Cork Insert, Step Cone, Taper Cone, Pulley Bushings, Stationary and Adjustable Mule Pulley Stands, Single and Double Brace Binder Frames, and Guide Pulleys.



Pulley

BELT TIGHTENERS

The upright design has triangular shaped sides, Style A has pulley and bearings set as shown in the illustration, and while in Style B these are fitted to the vertical side of the frame, Style C is a post or wall pattern. We also make Horizontal and Rack and Pinion Belt Tighteners.

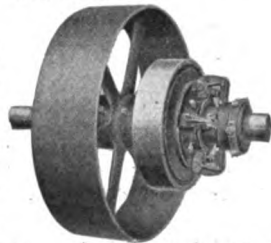


Belt Tightener

UNIVERSAL GIANT FRICTION CLUTCH WITH EXTENDED SLEEVE

This clutch is made with an extended sleeve of standard diameter, so that an ordinary pulley, gear, rope sheave or sprocket can be used by simply keying it on sleeve of clutch. It is only necessary that the bore be same as diameter of sleeve, just as if bored to fit a line shaft. This feature eliminates the expense and delay of making up special pulleys, as is usually required.

The Universal Giant Friction Clutch is designed so that the outer rim covers and protects the friction surfaces from dust, dirt, or any foreign substance. The life of all wearing parts is thus greatly prolonged and the clutch is made especially valuable for use in cement mills, phosphate factories, elevators, or any place where dust or gritty substances are afloat in the air.



Universal Friction Clutch Pulley

SHIFTERS, ETC.

We have a type which permits attaching to any of our hangers; also Fork and Lever Stands, Compound Lever, Worm Geared, Single Spur Geared and Double Spur Geared, Shifter Stands.

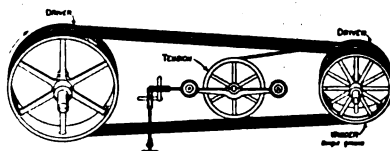


Compound Lever Shifter Stand

ROPE TRANSMISSION

We are prepared to make complete installations in either the English or American system and also furnish Rope Sheaves in various styles, Tension Carriages; Track and Track Hangers.

We have at your command engineers who have had years of experience in rope driving, and whom we will be glad to have plan a drive to meet conditions as they may exist.



Rope Drive

ROYERSFORD FOUNDRY AND MACHINE CO.

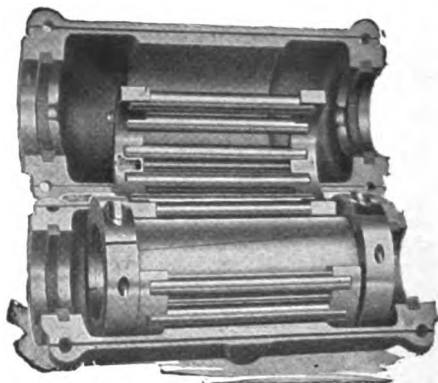
52 N. 5TH ST., PHILADELPHIA, PA.

Manufacturers of Roller Bearings and Other Power Transmission Machinery

SELLS ROLLER BEARINGS

Installation

Ease of installation is one of the prime advantages of "Old Reliable Sells Roller Bearings." Every Sells Roller Bearing fits practically every standard drop hanger, post hanger and pillow block. The split construction of Sells Roller Bearings—which will be discussed later—fits every Sells Roller Bearing to three different shaft sizes. Installation is simpler than with babbitted bearings and can nearly always be made over night.



"Sells" Roller Bearing Boxes
With Single Roller Structure
For Line Shafts and Counter Shafts

Sells Roller Bearings Reduce Friction and Save Shaft Wear

A close, five-minute study of the accompanying illustration will show you plainer than words why the all-split, quick-applied "Sells" is the foremost, friction-reducing, shaft-saving bearing on the market.

Old Reliable Sells Roller Bearings

Note the split steel bushing that protects the shaft, the collars that clamp it fixedly to the then-protected shaft. See also the split roller structure; how it separates the rollers, eliminating roller-against-roller frictions. It holds the rollers parallel to the shafting and each other. Friction is obviously eliminated at every point because the bearing is of the full-floating type.

The Split Box

The split box is made of a special composition, carefully machined. It is split with a milled tongue-and-grooved joint and the halves are bolted together.

When the bearings are applied the roller cages are greased thoroughly and additional grease can be applied through an opening on the top half of the box whenever necessary.

Size of Shaft Inches	Price	L'gth of Box Inches	Width of Box Inches	Height of Box Inches	Code
1" & 1 1/4"	\$3.00	6 3/4"	2 1/4"	2 3/4"	Ibex
1 1/4" & 1 1/2"	3.50	6 1/4"	3"	3 1/4"	Ice
1 1/2" & 1 3/4"	4.00	7 1/4"	3 1/4"	3 3/4"	Idea
1 3/4" & 2"	4.75	8"	3 3/4"	4 1/4"	Idiot
2" & 2 1/4"	5.50	8 3/4"	3 3/4"	4 3/4"	Idol
2 1/4" & 2 1/2"	6.75	9 3/4"	4 1/2"	5 1/4"	Ignite
2 1/2" & 2 3/4"	7.75	10 3/4"	4 3/4"	5 3/4"	Ilk
2 3/4" & 3"	9.50	10 1/2"	5 1/4"	6 1/4"	Image
3" & 3 1/4"	11.25	11"	5 1/2"	6 1/4"	Imbibe
3 1/4" & 3 1/2"	17.25	11 1/2"	5 1/2"	6 5/8"	Immerse
3 1/2" & 3 3/4"	19.25	12 3/4"	6 1/8"	6 7/8"	Impose
3 3/4" & 4"	33.50	14 1/4"	6 1/4"	7 1/4"	Imposter
4" & 4 1/4"	38.50	15"	7 1/8"	7 3/4"	Improve
4 1/4" & 4 1/2"	44.00	15 1/4"	7 3/4"	8 1/8"	Inapt
4 1/2" & 4 3/4"	50.00	16 1/2"	8"	8 1/2"	Inca
4 3/4" & 5"	50.50	16 3/4"	8 1/2"	8 3/4"	Incense
5" & 5 1/4"	64.00	17"	8 3/4"	9 1/8"	Income

Heavy Duty "Sells" Roller Bearing Boxes
With Double Roller Structures
For Main or Jack Shafts and Heavy Belt Pulls

Size of Shaft Inches	Price	L'gth of Box Inches	Width of Box Inches	H'ght of Box Inches	Code
1 1/4" & 2"	\$9.50	13"	3 1/4"	4 1/4"	Impound
2" & 2 1/4"	11.75	13 3/4"	4 1/2"	5 1/4"	Imprint
2 1/4" & 2 1/2"	13.25	14 3/4"	4 3/4"	5 3/4"	Inarch
2 1/2" & 2 3/4"	16.25	15 1/4"	5 1/4"	6 1/4"	Inborn
2 3/4" & 3"	19.50	15 3/4"	5 3/4"	6 3/4"	Inbred
3" & 3 1/4"	29.50	17 1/4"	5 1/2"	6 5/8"	Inclose
3 1/4" & 3 1/2"	33.00	17 1/2"	6 1/4"	6 3/4"	Incong
3 1/2" & 3 3/4"	47.00	19 1/4"	6 1/4"	7 1/4"	Indeed
3 3/4" & 4"	55.00	19 3/4"	7 1/4"	7 3/4"	Indent
4" & 4 1/4"	63.00	21"	7 1/4"	8 1/4"	Index
4 1/4" & 4 1/2"	70.00	21 3/4"	8"	8 1/4"	Indigo
4 1/2" & 4 3/4"	80.50	22 3/4"	8 1/2"	8 3/4"	Induce
4 3/4" & 5"	89.50	24"	8 3/4"	9 1/4"	Infant
5" & 5 1/4"	115.00	24 3/4"	9 3/4"	10"	Increase
5 1/4" & 6"	158.00	26 1/2"	10 3/4"	11 1/4"	Incourt

ROYERSFORD FOUNDRY AND MACHINE CO.

We Guarantee

a reduction in the friction load of from 25% to 50% which will more than pay for the cost of substitution each year. Let us give you specific instances of savings in production, with figures and signatures.

ROLLERINE



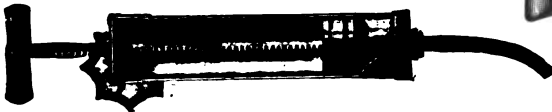
"ROLLERINE" is compounded expressly for the lubrication of "Sells" Roller Bearings and is the best lubricant for all roller and ball bearings. "Rollerine" contains 97% of lubricating properties and less than 1/2% residuum.

When "Rollerine" is used to lubricate "Sells" Bearings, maximum efficiency is obtained, and the life of the bearings insured under normal conditions of line-shaft service. Write for free sample.

"SELLS" OIL-AND-GREASE GUN

The "Sells" Gun affords the most efficient means for applying "Rollerine" to "Sells" Roller Bearings. It is also adapted for heavy oils and greases of all kinds.

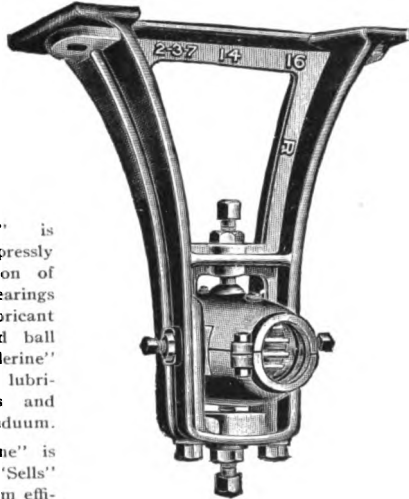
The hand wheel operating a pinion meshing in the rack makes it easy to control the amount of lubricant forced out. Its economy is very apparent. A curved nozzle adds to the convenience in applying the lubricant.



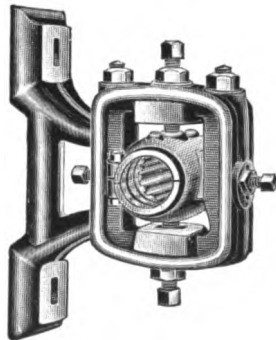
"Sells"
Oil-and-Grease Gun

All parts brass except the steel pinion and malleable iron hand wheel.

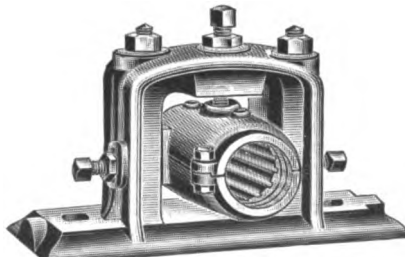
Workmanship and material first class. Finish throughout, high grade.



The "Sells" Roller Bearing Drop Hanger



The "Sells" Roller Bearing Post Hanger



The "Sells" Roller Bearing Floor Stand

AUBURN BALL BEARING COMPANY

Established 1893

22 ELIZABETH STREET, ROCHESTER, N. Y.

Manufacturers and Engineers

Ball Bearings for Every Service



Open T-114 Style
Single Thrust



AUBURN FOUR POINT CONE CON-
TACT BALL THRUST BEARINGS

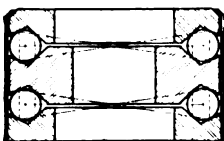
Each ball contacts constantly with both an inner (shorter) and an outer (longer) track on each race, yet it slides on neither of the four tracks, but rolls as freely as in a straight line across a table, and thus practically without friction. Made in sizes from $1\frac{1}{4}$ inches to 26 inches outside diameter.

Write for bulletin of sizes.

We design and make special ball bearings for unusual conditions of service when bearings of regular size or design are not entirely suitable. Send particulars of your problems.



Enclosed T-100 Style
Single Thrust



Enclosed T-150 Style
Double Thrust



Enclosed T-170 Style
Spherical Seat Thrust



Single Row



ANNULAR BALL BEARINGS

Made to Metric or English dimensions in sizes from $1\frac{1}{4}$ inches diameter to 26 inches outside diameter.

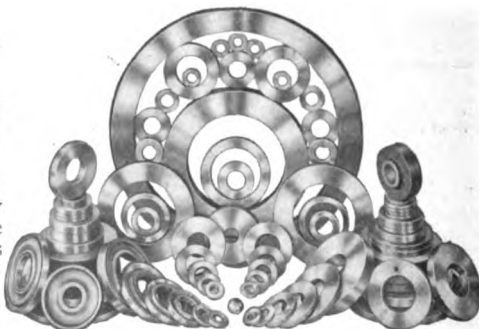
Write for bulletin of sizes.



Double Row



VALVE BALLS
Solid and Hollow
of Brass, Bronze
and other metals
from $\frac{1}{8}$ inch up



COLLARS AND RACES
of tool steel made to customers' specifications.



STEEL BALLS
of alloy and
carbon tool
steel from $\frac{1}{8}$
inch up.

GURNEY BALL BEARING COMPANY

JAMESTOWN, N. Y.

GURNEY BALL BEARINGS



In the Gurney Ball Bearing, by virtue of certain refinements in its construction, the applicability of the annular type is extended in the following definite particulars:

First—In mere *Capacity*—By reason of the more correct and exact contour of the raceways made possible by our special grinding machines.

Second—*Higher Speeds Possible*—By reason of our process of Concentric Grinding.

Third—*Larger Thrust Loads Permissible*—Due to its unique construction, safely carrying thrust loads much

in excess of those possible with any other radial bearing, while in our Radio-Thrust bearing thrust loads are carried up to 150% of the rated load of the bearing.

All Gurney bearings are made of the best obtainable chrome steel. The heat treatment of the steel is in accordance with the latest metallurgical science, and with the latest and best equipment.

155

Gurney Radio-Thrust Bearings are specially applicable not only where there is a combination of thrust and radial loads but in certain cases they are superior to ordinary thrust bearings for carrying simple thrust loads. They work with much less friction than the ordinary thrust ball bearings. Hence where speeds are high they carry thrust loads with greater efficiency.

Radio-Thrust Bearings are made to the same dimensions as regular annular bearings and interchangeable therewith. They are also made in a wide series interchangeable with common double row ball bearings. Adapted to take various degrees of thrust.

The application of ball bearings in various special cases, such as the worm drive, the spiral bevel gear, internal gear drive, etc., etc., is very exhaustively covered in the Gurney Ball Bearing Engineering Bulletin, which is published from time to time and sent free to those requesting such special service.

The Gurney Ball Bearing Handbook is the most exhaustive exposition of the application of ball bearings to motor cars ever compiled. It gives very complete data and formulas for calculating loads in all cases.



It is supplied in a loose-leaf leather binder for..... \$2.75
In pasteboard covers for..... 1.75
Loose-leaf, perforated for standard binder, for..... 1.50

THE HESS-BRIGHT MFG. COMPANY

PHILADELPHIA, PA.

Manufacturers of Annular and Thrust Ball Bearings

HB

HESS-BRIGHT BALL BEARINGS

DWF

are used in

Lineshaft Hangers

Machine Tools

Dynamos and Electric Motors

Automobiles, etc.

Trolley Cars

Woodworking Machinery

Flour Milling Machinery

Special literature on request, describing the above and other applications.

Aside from the economy in power which they make possible, Hess-Bright Ball Bearings effect important savings in repair and upkeep charges, due to the fact that wear is virtually absent.

ANNULAR BEARINGS



HESS-BRIGHTS of "heavy," "medium" and "light" series, for same shaft size

Made regularly in sizes up to 110 mm. (4.3307 inches) shaft diameter. Special sizes to order if quantity is sufficient.

Three series: "Heavy," "Medium" and "Light," for equal shaft sizes.

Hess-Bright Annular Bearings are so constructed that the sides of the races are unbroken. This fact has an important bearing on durability.



HESS-BRIGHT
THRUST BEARINGS

THRUST BEARINGS

Made regularly in sizes up to 105 mm. (4.1339 inches) shaft diameter. Larger sizes on special order.

Two series: "Medium" and "Light."

One-direction and two-direction types with or without aligning washers, though the use of such washers is recommended.

Our plants are the largest in the world devoted exclusively to ball bearing manufacture, and with the extensive enlargements and improvements which we have made (our factories now cover approximately 17 acres of floor space), we feel justified in saying that our resources and facilities for immediate delivery are unequalled.

THE NEW DEPARTURE MFG. CO.

BRISTOL, CONN.

Conrad Patent Licensee

Western Branch
818-20 Ford Building
DETROIT, MICHIGAN

Distributors For Continental Europe
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LONDON-MANCHESTER

NEW DEPARTURE

Double Row

Single Row



BALL BEARINGS

Radax

Magneto

American Made for American Trade



Double Row

THE DOUBLE ROW is a distinctive, dual-purpose, self-contained unit, developed, patented and guaranteed by this Company. It has two sets of balls and raceways, mounted in such relation that radial loads and end thrusts, singly or combined, are successfully resisted.



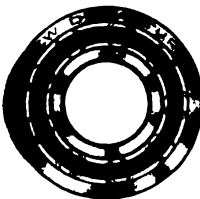
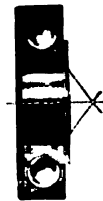
Single Row

THE SINGLE ROW, in diameter, width and bore, is Internationally standardized and, therefore, interchangeable with other makes of bearings of this type. Maximum number of large balls, improved separator. A strictly radial bearing.



Radax

THE RADAX, a cup and cone bearing with angular load line of 35° from normal. For use where one direction thrust is present, either singly or combined with radial load. In dimensions it is interchangeable with corresponding sized single row annular bearings.



Magneto

THE [MAGNETO, designed to carry light loads at high speeds. Due to the design of the races and slight angular contact line, it will sustain light end thrusts as well as radial loads, and is noiseless in operation.



Made in a large variety of sizes: Absolutely guaranteed: Unexcelled Service.

Send for a set of our Engineering Data Sheets.

THE NORMA COMPANY OF AMERICA

1790 BROADWAY, NEW YORK, N. Y.

"Norma" Ball, Roller, Thrust and Combination Bearings

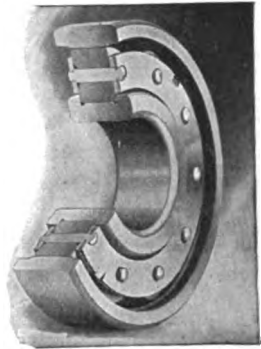


"NORMA" BALL BEARINGS

Open type, separable bearings of extremely high precision, rigidly mounted, silent running, with every element in workmanship and design contributing to high efficiency, long-time service; notably successful in high-speed operation, being the standard bearings with most of the leading manufacturers of high-speed electrical apparatus.

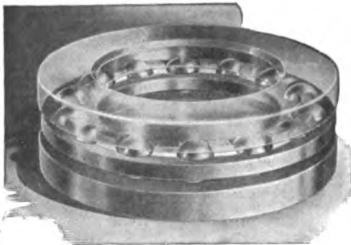
"NORMA" ROLLER BEARINGS

Heavy-duty, high-efficiency bearings preëminently adapted for service where shock, jar, vibration and sudden load variations must be encountered; double the load capacity of a ball bearing of the same dimensions; temporary overload capacity up to 50 per cent of their own rating; high-speed, quiet-running units of extreme precision and maximum durability.



"NORMA" THRUST BEARINGS

Precision units affording maximum anti-friction efficiency under end thrust loads; designed to afford long-service durability and silent-running qualities; made in several styles, single and double, both without housings and with housings of several types giving self-contained advantages.



"NORMA" COMBINATION BEARINGS

Self-contained units affording perfect adjustment and maximum anti-friction efficiency under combined radial and thrust load; two types—combined annular and ball thrust, and combined roller and ball thrust; distinguished by high precision, open-type construction, rigid mounting, silent-running and high-speed qualities.



Send for the complete catalog
"Norma Precision Bearings."

ATLAS BALL COMPANY

GLENWOOD AVENUE AT FOURTH STREET

PHILADELPHIA, U. S. A.

Manufacturers of Steel Balls for Bearings

ATLAS STEEL BALLS

Accuracy

Uniformity

Quality

ATLAS BALLS are the recognized standard steel bearing balls of American manufacture, and the peer of any bearing ball in the world. Our constant efforts to perfect a product that our guarantee could cover without any exceptions have been appreciated by ball bearing, automobile and high grade machinery manufacturers who are the acknowledged leaders in their respective fields.



We have met the demand for a perfect ball—the Atlas process of grinding insures round balls of uniform accuracy.

The balls go through a process which includes forging, three stages of grinding, annealing, hardening and polishing, the nature of which produces balls of uniform cross-section, *hard clear through*, and absolutely accurate within .0001 of an inch.

We make one grade of balls only—the highest—and confine ourselves to that grade.

Chrome Alloy Steel of special analysis is used in making Atlas Balls. This steel is hardened clear through and is the very highest quality that can be used.



Atlas Balls stand the test of time, wear and of every known formula for determining quality and exactitude.

Important

We guarantee accuracy to within one-tenthousandth of an inch to size. Every box is sealed and the contents will be found to be as represented.



THE G WILLIAM COMPANY

THE NEW DEPARTURE SERVICE STATION

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'PHONE: COLUMBUS 8356

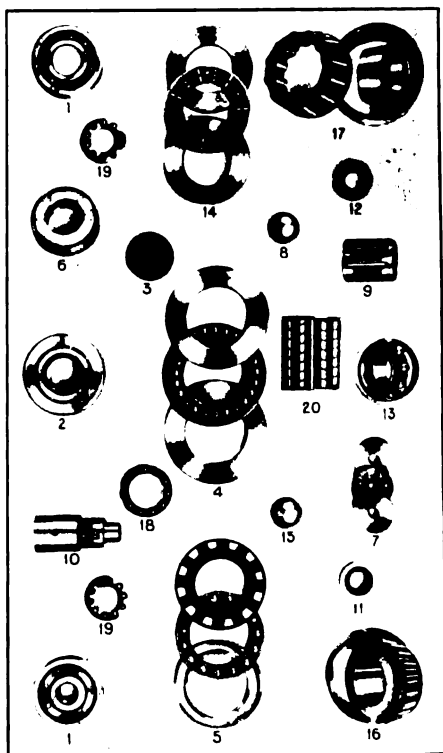
PHILADELPHIA: 1314 ARCH ST., 'PHONE: WALNUT 3497

Engineers and Specialists in Bearings

BALL AND ROLLER BEARINGS

Types of Bearings in Stock or To Order

1. Annular Ball Bearing.
Single Row.
2. Annular Ball Bearing.
Double Row.
3. Ball Bearing Sheave.
4. Ball Thrust Bearing.
Collar Type.
5. Ball Thrust Bearing.
With threaded washer.
6. Ball Thrust Bearing.
Groove type, with Band.
7. Ball Thrust Step Bearing.
8. Bronze Ball.
9. Journal Roller Bearing.
10. Journal Roller Bearing.
With casing and sleeve.
11. Pressed Steel Annular Bearing.
12. Pressed Steel Combination Bearing.
13. Radax Bearing.
14. Roller Thrust Bearing.
15. Steel Ball.
16. Taper Roller Bearing.
17. Taper Roller Bearing.
Cage type.
18. Thrust Bearing Retainer.
Open type.
19. Thrust Bearing Retainer.
Closed type.
20. Hyatt Roller Bearing.



AUTOMOBILE AND TRUCK BEARINGS

We can supply bearings for most of the present day cars, and many of the cars that have become "ORPHANS" within ten years—when ordering send old bearings.

Call, 'Phone or Write.



THE BUNTING BRASS & BRONZE CO.

729 SPENCER ST., TOLEDO, OHIO

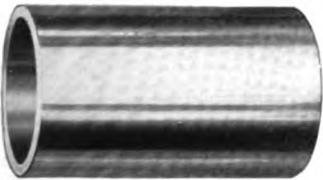


BUNTING'S PATENTED MACHINED BRONZE BUSHINGS AND BEARINGS

We are in a position to offer Bronze Bushings and Bearings Completely Machined and ready for Assembly at a saving in cost of from 10% to 100% over the cost of the castings and machine work.



We have demonstrated the above fact to more than 300 concerns, whom we supply with our material, and who are in most cases the largest and most prominent companies manufacturing Machine Tools, Automobiles, Automobile Parts, Engines, Agricultural Machinery, Etc.

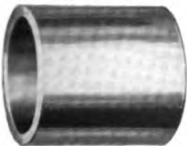


These users are ready to testify that we are able to produce these parts in quantity, machined complete, far more cheaply and of a much better grade of material and workmanship than they could do it themselves.



We operate our own bronze foundry and use specially designed semi-automatic machinery in the manufacture of our product.

Bunting Standard Phosphor Bearing Bronze used in all Bushings, unless otherwise specified, in which case special price applies. Bunting Bearing Metal is the highest grade possible to secure.



We require NO PATTERNS OR TOOLS.

We use your own composition if you prefer.

We quote prices from Blue Prints, Samples or send us dimensions.

The Above Illustration Shows Several Styles of Our Bronze Bushings

Directions for Ordering: Dimensions—All inside and outside dimensions must be furnished in decimals, thus, 1.503". Diameter dimensions guaranteed to be within .001". All dimensions given in common fractions will be held to commercial accuracy, viz., .01".

BOSTON BELTING COMPANY

84 LINDEN PARK ST., BOSTON

NEW YORK 100-102 Reade St. BUFFALO 90 Pearl St. CHICAGO 172 W. Randolph St. SAN FRANCISCO 55 First St. PORTLAND, OREGON 105 First St.

Manufacturers of Mechanical Rubber Goods: Belting, Hose, Packing, etc.

TRANSMISSION BELTING

Rubber Belting is perfectly uniform in width and thickness. It is not readily affected by heat or cold and is well adapted for use in damp and wet places. It is strong, durable, grips the pulleys closely and does not slip.

Brands—Excelsior Red Frictioned, Imperial Stitched, Elmwood, Boston, Niagara, Trimount, Universal, Special Excelsior.

Adapted for all conditions of service; made from qualities and weaves of duck and grades of rubber which assure maximum service and economy.

Gutta-Balata Belting—a high-grade textile belt, adapted for power transmission, also for conveying; so constructed that belts four-ply and heavier have absolutely seamless faces, and either side can be run next the pulleys; not injuriously affected by moderate quantities of oil or grease.



CONVEYOR BELTING

Made all widths and thicknesses, with regular rubber cover, or extra thick rubber cover on one or both sides, and reinforced edges; adapted for use on straight or troughing pulleys, for carrying coal, ores, grain, gravel, sand and other materials.

HOSE

Rubber, for water, steam, gas, air, suction, oil and fire protection.

Roxbro Braided Hose, which is furnished in continuous lengths up to 500 feet, is especially recommended for pneumatic use.

Cotton Hose, rubber lined, furnished in light and heavy single fabrics and medium and heavy jacket fabrics for all kinds of fire protection equipment.

Unlined Linen Hose. American Underwriters; supplied in all sizes and lengths, for interior fire protection equipment. Approved by all insurance interests.

PACKINGS—sheet form, for flanges and joints; adapted for all conditions of service. Piston and valve rod packings, round, square and spiral; for hot and cold water and hydraulic purposes.

RUBBER PUMP VALVES—made in all shapes and sizes for different styles of pumps and various service conditions.

RUBBER COVERED ROLLERS. New Rollers Complete. Rollers Recovered.

High-grade coverings, made from selected gums; adapted for paper and textile mill uses, tanneries, tobacco factories, and every purpose for which rubber-covered rollers are used.



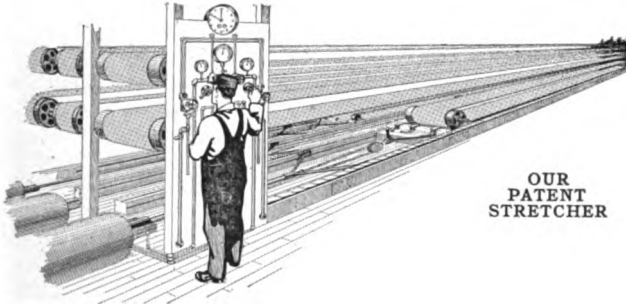
H. N. COOK BELTING COMPANY

Established 1880

SAN FRANCISCO, CALIFORNIA, U. S. A.

Cable Address: Horatio

Manufacturers of Patent Stretched Leather Belting



We own and control patents covering process and machinery, shown as above, for testing and stretching leather belts. Briefly, these belts are laced on over a series of pulleys and operated under pneumatic tension, according to the width and thickness of the belt, with the view of not only testing the laps and other portions of the belt, but stretching it. We take out of our belts from 3 to 4 per cent on these stretchers and supply you with a belt that is practically worked down to its bearings.

STOCK
WORKMAN-
SHIP

Belts listed herewith are all made from CENTER CUTS of PURE OAK TANNED BELTING BUTTS from which all shoulder and flank have been removed. Strips are all carefully sorted and fitted so as to make well-balanced belting. New lapping machines recently installed cut perfect splices which means uniform belting. Cementing is done under heavy Hydraulic Pressure after which our belting is submitted to our stretching process as shown above

DOLPHIN WATERPROOF CEMENT PATENT STRETCHED BELT

Made in all weights.

For damp and wet places.

OUR
BRANDS
FIRST
QUALITY
BELTING
AND
HOW
USED

The cement with which this belting is made not only resists moisture, but heat and oil as well.

GOLDEN STATE PATENT STRETCHED BELT—EXTRA HEAVY

We make an *EXTRA HEAVY* single belt in this grade, which can be used where it is not practical to use a double belt, and where more than an ordinary single belt is required. We also make a *DOUBLE* belt in this grade measuring about $\frac{1}{4}$ " thick, which is sometimes used in place of a three-ply belt, particularly where the pulleys are not large enough for three ply. We also make this belt in three ply for extra heavy drives.

GOLDEN STATE PATENT STRETCHED BELT—HEAVY

The single belts in this weight are used for all ordinary purposes. The double belts are used where pulleys are of fair size and where the belt is called upon to do heavy duty. Three-ply belts of this grade are particularly adapted for *MAIN DRIVES*.

PROGRESS PATENT STRETCHED BELT is a **MEDIUM WEIGHT** belt. The single is adapted for most any drive. It is made of the same quality of leather as the above, only it has not quite the body. The Doubles are adapted for medium diameter pulleys and medium speeds. The three plies are particularly adapted for **HEAVY GENERATOR WORK**.

GOLDEN STATE DYNAMO PATENT STRETCHED BELT—for **Dynamos** and **High Speeds**. It is made principally in doubles.

PRICE LIST.—We sell on the standard list, which is figured on a twenty-four cent basis for belt one inch wide by a foot long—thus belt 10" wide would list 10 X 24 or \$2.40. Double belts are twice the price of single and three-ply belts are three times the price of single. Prices of the above grades vary according to weight. In other words, light belting is sold at a cheaper price than medium or heavy etc. The prices are governed by discounts which we will quote on application.

CORRESPONDENCE IN SPANISH AND RUSSIAN.

L. H. GILMER CO.

VINCENT ST., TACONY, PHILADELPHIA

Manufacturers of Woven Endless Belts, Belting, Webbing, Tapes



GILMER ENDLESS BELTS

Pat. March 22, '03.

Our Endless Belts are used for light and heavy power transmission, at high and low speed, conveying, polishing and sanding. They give equal satisfaction on the lightest high speed Ball Race Grinders and the heaviest Car-lighting Axle Generators.

One belt cannot be made to serve all purposes. A belt which will give satisfaction in a dry, well-heated room, will not work when exposed to steam or water. Nor will a belt which gives satisfaction where it comes in contact with oil and grease, be at all satisfactory in a room filled with dust and lint. We have therefore developed a special weave and grade of belt for each particular purpose.

164

Our Endless Belts are used on Ball Race Grinders, Internal and Cylinder Grinders, Lathes, Drill Presses, Planers, Shapers, Joiners, Motors and Lighting Generators, for Threshing Machines, Saw-mills, Routers and Carvers, Fan Drives, Quill Winders, and many other drives similar to above, for power transmission. Also used for Folding, Wrapping and Labeling machines. For conveying Candies, Pharmaceutical goods, Groceries, Hardware and Metal parts and bricks; on Weighing Machines, Dish-washers, Paper and Box machinery; for Sanding and Polishing all kinds of Wood and Metal work.

We make Woven Endless Belts in all widths, all thicknesses, and all lengths. They are of a uniform thickness, strength and pliability. Have minimum stretch and maximum efficiency. Are necessary for high speed, advisable for all speeds. They are endorsed by nearly every manufacturer making machinery on which Endless Belts can be used.

Our experimental department is always willing to develop special belts for new lines. We will take pleasure in helping develop machinery using Endless Belts. Our experience and service is always at the call of those desiring it. Our methods and equipment are such that no order is too small to receive prompt and thorough attention. We can make up an order for one belt or for one million belts.



THE B. F. GOODRICH COMPANY

AKRON, OHIO

Offices in all principal cities

Manufacturers of Mechanical Rubber Goods, Tires, etc.

BELTING

TRANSMISSION BELTS—Main drivers require the best quality. Weight and weave of duck, amount of stretch in service, and character of cover should be considered. We recommend the following grades:

"Commander"—friction-surface, gum cushion under first ply, extra quality for extreme service conditions.

"Pinnacle"—friction-surface, maximum strength, extreme quality.

"Pilgrim"—regular covered, heavy duck, good friction and cover; for general service.

On small pulleys operating at high speed we recommend:

"Marathon"—a friction-surface belt of highest quality, built on special woven light, flexible duck.

Light drives, such as agricultural service, are well met by **"Rob Roy,"** built on medium duck, and **"Signal,"** built on light weight duck.

"B. F. G. Drilling," **"Sterling Stitched"** and **"Oilfield Stitched"**—for all conditions of service in the oil fields.

CONVEYOR BELTS for conveying ore, coal, rock, etc., call for special qualities in the belt that have taken years of practical experience to develop. A duck of maximum strength and extreme flexibility, a strong friction, a wear-resisting cover, which will remain pliable and an edge armored against chafing are all required. We offer the following grades:

"Goodrich Dredge"—for the hardest conditions known to conveyor belt practice.

"Longlife"—for severe service, where extreme wear and economy are desired.

"Maxecon"—for ordinary service; medium priced, but reliable and serviceable.

"Cossette" Belt—one of exceptionally high quality throughout, for handling cossettes in beet sugar factories.

"Whitcover" Canning Belt—special white sanitary cover for food canning factories.

Grader Belt—Recommend **"Maxecon"** with $\frac{3}{4}$ or $\frac{1}{2}$ " top cover.

For **GRAIN ELEVATOR BELTS** we offer the following:

"Maxecon," **"Meteor"** and **"Summit"**—horizontal carrier belts.

"Pilgrim," **"Mainstay"** and **"Safety"**—bucket-leg belts.

ELEVATOR BELTS for mines and quarries require a duck of extra strength, quality and weight to resist the tensile strains and the action of the bucket bolts. We use a special, heavy duck and recommend the following belts:

"Goodrich" Elevator Belt—special high grade for most severe service, especially recommended for wet mine elevators.

"Akron"—high grade, designed for hard duty.

"Cost Cutter"—designed for general conditions but has operated satisfactorily in hard service.

"GOODRICH AXLE LIGHTING" belt meets the severest service known—that of the electric train lighting from the car axle.

POLISHING BELTS—Sometimes called Emery Belts; built on especially strong fabric with high quality, tough ignition.

We are also prepared to furnish Magnetic Take-Off Belt, Separator Belts, etc.



THE GRATON & KNIGHT MFG. CO.

Oak Leather Tanners and Belt Makers

WORCESTER, MASSACHUSETTS, U. S. A.

Atlanta, Ga.
Boston, Mass.
Chicago, Ill.
Cleveland, O.

Detroit, Mich.
Fall River, Mass.
Kansas City, Mo.
Minneapolis, Minn.

New York, N. Y.
New Orleans, La.
Philadelphia, Pa.
Pittsburgh, Pa.

Portland, Ore.
St. Louis, Mo.
Seattle, Wash.
Leicester, England

SELLING AGENTS

Graton & Knight Mfg. Co. of Texas, Dallas, Tex.

Graton & Knight Mfg. Co. of Wisconsin, Milwaukee, Wis.

Graton & Knight Mfg. Co. of California, San Francisco, Cal.

LEATHER—LEATHER BELTING—LACE LEATHER BELT CEMENT—BELT DRESSING

Packings—Strappings—Automobile Leathers

Solid and Twist Round Belting—Block and Link Type "V" Belts

BELTING

Spartan Belting is made in all plies from specially tanned leather to withstand the effect of steam, water, oil, heat, gas and acid fumes. It is unusually pliable, and possesses great tensile strength—a belt specially recommended for difficult drives.

Neptune and **Special Planer** are Waterproof Belts, made from center stock of the choicest Oak Tanned Leather. Neptune is made in all plies. Special Planer is made only in extra heavy single and not over 4" in width.

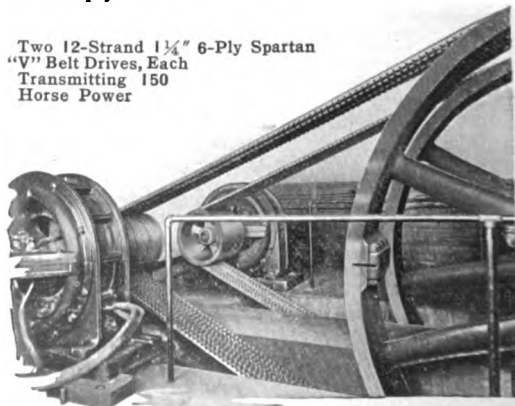
Heart, **GraKnight** and **GraKnight Dynamo** are all brands of strictly first quality belting, cut from center stock of the choicest Oak Tanned Leather. These three brands differ only in the weight and consequent thickness of the leather used in their construction. The Heart and GraKnight are made in all plies, while the GraKnight Dynamo is furnished principally in doubles.

Extra Short Lap and **Pryzoak** are what we term second quality brands of belting. They are cut from a good selection of side stock Oak Tanned Leather, and differ only in the weight of the leather used in their construction. Both brands are made in single and double ply and not over 6" in width.

Spartan "V" Belts

An efficient means of transmission for difficult drives—motor drives with short centers, lighting systems, or for any place where a silent and efficient drive is required. The thickness and construction of Spartan "V" Belts vary to meet the requirements of each application.

Two 12-Strand $1\frac{1}{4}$ " 6-Ply Spartan
"V" Belt Drives, Each
Transmitting 150
Horse Power



Our Engineering Department will gladly investigate or design any drive upon request. Let us consult with you.

MAIN BELTING COMPANY

PHILADELPHIA
PITTSBURGH

CHICAGO
SEATTLE

NEW YORK
BIRMINGHAM

Represented in Canada by MAIN BELTING CO. OF CANADA, LTD., MONTREAL
Manufacturers and Engineers: Sole Manufacturers of Leviathan and Anaconda Belting, Main Adjustable Conveyor Rollers

LEVIATHAN-ANACONDA BELTS

Are totally unlike any other belts in the world, various ply, of solid fabric, so impregnated with a special composition, treated, stretched and aged as to form a pliable belting material well-nigh indestructible.

Symmetry in balance of moving parts is the ideal to which every power engineer works. There never has been another belting material so uniform, yard for yard, in weight and tractiveness, as Leviathan-Anaconda.

LEVIATHAN and ANACONDA are used for Elevating, Transmitting, Conveying, according to conditions. They stretch less, and need less take-up than any other belts.

If in doubt as to which belt is needed, write our nearest office.

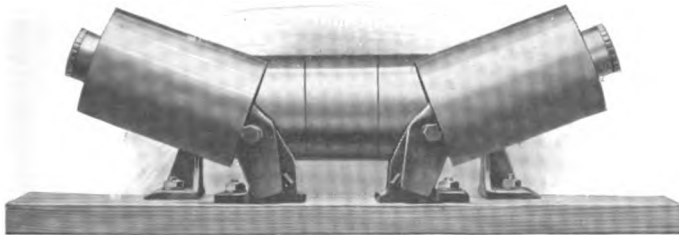


TRADE MARK

Our Engineering Department is at your service to help you meet the conditions you have. This puts you under no obligations. We want your orders, but we expect them only on squarely earning your confidence without favor.

167

Our responsibility for every Leviathan belt and every Anaconda belt continues *after the belt is placed in service* until it has earned its full cost as compared with the service under the same or similar conditions of any belt of any kind.



MAIN ADJUSTABLE CONVEYOR ROLLERS

Main Adjustable Conveyor Rollers are adjustable with a maximum angle of 20°. They have no groove or opening at the troughing point, the rims of the troughing pulleys are reinforced and the principal parts are interchangeable, being the same for all sizes.

THE ROSSENDALE-REDDAWAY BELTING & HOSE CO.

NEWARK, N. J., U. S. A.

Manufacturers of "Camel" Brand, Stitched Canvas, "Black Bird" Solid Woven,
and Bird's Bull's-Eye Belting

"CAMEL HAIR" BELTING



Reg. Trade Mark

For Power Transmission.

This belt is remarkable for its great strength (almost twice that of the leather belting), long life, small slippage, minimum stretching, straight true running, and for the fact that it is less affected by dampness or acid fumes than any other kind of belting. This belting is also sold under a guarantee that it will give longer, better service than any other style of belting running under the same conditions.

BIRD'S BULL'S-EYE BELTING



Reg. Trade Mark

For Power Transmission and for Conveying.

SOLID WOVEN BELTING

"Black Bird"

Reg. Trade Mark

For Power Transmission and for Conveying.

STITCHED CANVAS BELTING

"Sphinx" Brand and lighter weights for all purposes.

BRAKE BAND LININGS

THE MECHANICAL RUBBER CO.

CLEVELAND, OHIO

Manufacturers of Belting, Hose, Packings, Mattings, Plumbers' Specialties, Automobile Goods, Tapes, Druggists' Sundries, Sporting Goods and Special Molded Articles

MARCO BELTING

**Friction
Surface**

"MARCO" Rubber Belting is made especially to fill the demand for high grade friction belting that will give satisfaction under the most severe conditions. It is manufactured without particular regard to cost, but rather for the promotion of a maximum of service—a guaranteed belt in every respect. The duck is heavy and strong, yet pliable; the friction shows what can be done when quality alone is considered.

2-X-L BELTING

**Friction
or
Rubber
Surface**

Discriminating buyers will appreciate the exceptional quality of 2-X-L Belt in everything that counts for economy. It stands the most critical examination, and is fully guaranteed. Not only do we claim that the belt is a splendid medium for the transmission of power which will offer absolute reliability, but we also recommend it highly as a conveyor proposition.

There are a number of classes of service to which this belt is especially adapted—cement mills, stone-crushing plants, saw mills and sand and gravel plants.

MARCO PACKINGS

"MARCO" is a brand name which applies to all our various packings. We manufacture packings suitable for every condition, and we ask you to communicate with our engineering department for suggestions and recommendations.

CHAS. A. SCHIEREN COMPANY

Established 1863

Tanners—Belt Manufacturers

30-38 FERRY STREET, NEW YORK

SEATTLE, WASH., 305 First Ave., South
NEW ORLEANS, LA., 404-406 Canal St.
DALLAS, TEX., The Texas Chas. A. Schieren Co.,
Inc., 205 So. Market St.
BOSTON, 641-643 Atlantic Ave., Op. So Station
OAK LEATHER TANNERIES, Bristol, Tenn.

PHILADELPHIA, 226 North Third St.
DENVER, 1752 Arapahoe St.
PITTSBURGH, 337 Second Ave.
CHICAGO, 128 W. Kinzie St.
PETERSBURG, VA., 122 Shore St.

DISTINCTIVE SCHIEREN BELTINGS

All of the finest quality, but selected to fill different requirements and guaranteed to do the work for which each is intended. Each belt is stamped every ten feet with its Trade Mark and the Chas. A. Schieren Company signature, which assures a full guarantee of workmanship and material.

Chas. A. Schieren Company
SIGNATURE

DUXBAK LEATHER BELTING

To Schieren belongs the credit of making the one leather belt which successfully meets the demands of belt users the world over. No matter where you may be located, whether in the far East, West, in the South or North, or what you may think a perfect belt should do, you are justified in specifying "DUXBAK" Waterproof Leather Belting.



Duxbak is of two kinds, **Waterproof** and **Steamproof**, not approximately, but absolutely, and is used for all belting purposes.

The **Waterproof** belt is for use in wet places where temperature does not exceed 140 degrees Fahrenheit.

The **Steamproof** belt is for use in live steam and all places where moisture is accompanied with extreme heat; also where belt is exposed to acid fumes or strong alkalis.

Cut from the backbone portion of oak-bark-tanned leather, tanned in our own tanneries.

Every belt guaranteed.

ROYAL EXTRA BELTING

For general mill work and where a high quality belting is essential.



BULL'S HEAD BELTING

For heavy drives, such as Rolling Mills and wide belts for Main Drives.

Interesting literature on the subject of belting may be had on request.



SHULTZ BELTING CO.

ST. LOUIS, MO., U. S. A.

BRANCH: 111 CHAMBERS STREET, NEW YORK

Manufacturers of Sable Rawhide Belting, Aqua Waterproof-Steam-Proof Belting, Oak Tanned Belting, Belt Dressing, Lace Leather, Etc.

SHULTZ SABLE RAWHIDE BELTING

Shultz Belting is made from the heaviest Packer Steer Hides, and the reason why this belting excels all others is because the leather is tanned by our own special process, and prepared from the raw material to the finished product under our own personal supervision.

SABLE Rawhide Belting is tanned on the surface—for contact, and the interior is rawhide—for strength. This, combined with its great strength and pliability, enables SABLE to hug the pulleys closer, transmit 25% more power, increase your production and outwear any oak tanned belt.



This Is Easily Done with Sable Belting of Double Thickness

SHULTZ AQUA BELTING

AQUA is an absolute Waterproof and Steam-proof Leather Belt. It is intended for laundries, dye houses, bleacheries, damp climates or any place where wet conditions exist.



Reg. U. S. Pat. Off.

Now here is where "Aqua" is different from other types of so-called waterproof belts. The waterproofing is tanned right in. It's waterproof on the surfaces and it's waterproof in the middle and remains waterproof under the worst conditions. You can boil a double in live steam and the plies will not separate or the leather lose its strength or pliability.

"Aqua" will outlast any rubber or canvas belt ever made and transmit from 25% to 33% more power.

Test Out

A SABLE Rawhide or AQUA Waterproof Belt on a 60 day "try-it-before-you-buy-it" basis. That is a mighty fair proposition, and it gives you an opportunity of letting your eyes be the judge, and your money the last thing you part with.



TRADE MARK

Write for catalogue No. 10.

JOHN A. ROEBLING'S SONS CO.

TRENTON, N. J.

Manufacturers of Wire Rope of All Kinds



We manufacture and keep in stock at our works at Trenton and at warehouses at agencies and branches in large cities wire rope, made from Iron, Cast Steel, Extra Strong Cast Steel, Plough Steel and Blue Center Steel.

We give below tables of strengths, etc., for the standard constructions of BLUE CENTER STEEL ROPE. The rope is also furnished with 6 strands of 37 wires each and with 8 strands of 19 wires each.

This rope is recommended as the best to use where extreme conditions tend to bring extraordinarily severe stresses, and is particularly well adapted to resist abrasion.

The hemp center of this rope is colored blue to distinguish it from other wire ropes.

BLUE CENTER STEEL HOISTING ROPE

Composed of 6 Strands and a Hemp Center, 19 Wires to the Strand

Trade Number	Diameter in inches	Approx. circumf. in inches	Approx. weight per foot	Approx. strength in tons of 2000 lbs.	Proper working load in tons of 2000 lbs.	Diam. of drum or sheave in feet advised
00	2 3/4	8 3/8	11.95	315	63	11
0	2 1/2	7 7/8	9.85	263	53	10
1	2 1/4	7 1/8	8	210	42	9
2	2	6 3/4	6.30	166	33	8
2 1/2	1 3/8	5 3/4	5.55	150	30	8
3	1 3/4	5 1/2	4.85	133	27	7
4	1 3/8	5	4.15	110	22	6 1/2
5	1 1/2	4 3/4	3.55	98	20	6
5 1/2	1 3/8	4 3/4	3	84	17	5 1/2
6	1 1/4	4	2.45	69	14	5
7	1 1/8	3 1/2	2	56	11	4 1/2
8	1	3	1.58	45	9	4
9	3/4	2 3/4	1.20	35	7	3 1/2
10	3/4	2 1/4	.89	26.3	5.3	3
10 1/4	3/8	2	.62	19	3.8	2 1/2
10 1/2	3/8	1 3/4	.50	14.5	2.9	2 1/4
10 3/4	1/2	1 1/2	.39	12.1	2.4	2
10a	1/2	1 1/4	.30	9.4	1.9	1 3/4
10b	1/2	1 1/8	.22	6.75	1.35	1 1/2
10c	1/2	1	.15	4.50	.9	1 1/4
10d	1/4	3/4	.10	3.15	.63	1

BLUE CENTER STEEL ROPE

For Haulages and Transmissions. 6 Strands and a Hemp Center, 7 Wires to the Strand

11	1 1/2	4 3/4	3.55	90	18	11
12	1 1/8	4 1/4	3	79	16	10
13	1 1/4	4	2.45	67	13	9
14	1 1/8	3 3/2	2	52	10	8
15	1	3	1.58	42	8.4	7
16	3/4	2 3/4	1.20	33	6.6	6
17	3/4	2 1/4	.89	25	5	5
18	1 1/4	2 3/4	.75	20	4	4 3/4
19	3/4	2	.62	17 1/2	3.5	4 1/2
20	1/2	1 3/4	.50	13	2.6	4
21	1/2	1 1/2	.39	11	2.2	3 1/2
22	1/2	1 1/4	.30	7 3/4	1.5	3
23	1/4	1 1/8	.22	6 1/2	1.3	2 1/2

A copy of our catalogue, giving information about other wire ropes, and wire rope fastenings will be mailed on application.



NEWHALL CHAIN FORGE & IRON CO.

90 WEST ST., NEW YORK

156 SECOND ST., SAN FRANCISCO

Welded Chains of Every Description

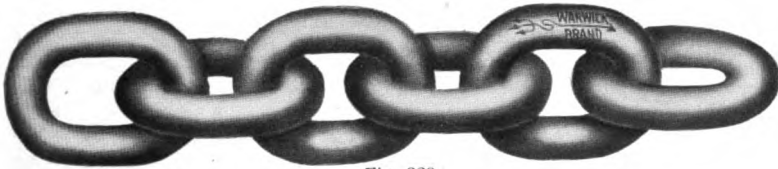


Fig. 320

STEAM SHOVEL AND DREDGE CHAINS, ALL SIZES

"TRIDENT"
LOADING CHAIN



"WARWICK"
DREDGE CHAIN

CHAINS FOR:

CARS
CRANES
CONVEYORS
DREDGES
ELEVATORS
HOISTS
LOGGING
MARINE
RAILWAYS
MILL TRUCKS
POCKET
WHEELS
QUARRIES
RAFTING
SPROCKETS
STEAM
SHOVELS
Etc.

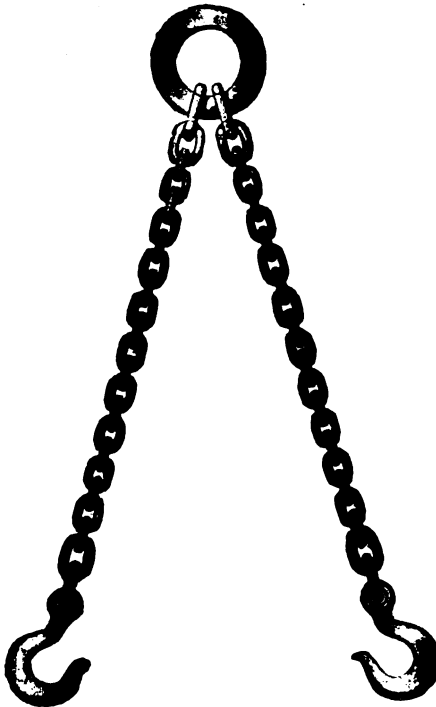


Fig. 355

SLING CHAINS, ALL STYLES

Write for Catalogue.

DROP
FORGINGS
HAND
FORGINGS
CHAIN HOISTS
CHOCKS
CLEATS
CLEVICES
COLD SHUTS
COMBINATION
DRILL PRESS
GUY CLAMPS
HOOKS
REPAIR LINKS
SHACKLES
SWIVELS
WIRE ROPE
CLIPS

H. W. CALDWELL & SON COMPANY

17TH ST. AND WESTERN AVE., CHICAGO, ILL.

EASTERN OFFICE: 50 Church St., NEW YORK CITY
711 Main St., DALLAS, TEXAS

**Manufacturers of Elevating, Conveying and Power Transmitting Machinery;
Machinery for Handling Material in Bulk or Packages**



HELICOID "CONVEYORS"

Sole manufacturers of HELICOID SCREW CONVEYOR made of one continuous strip of metal with-

out laps or rivets. Mounted on standard and extra heavy pipe or solid shafts.

PAN, APRON AND BELT CONVEYORS

Each designed and built to handle the material for which it is best suited, to the best advantage. For COAL, COKE, SAND, CRUSHED STONE, GRAVEL, GRAIN, BOXES, BARRELS, etc.



CHAINS

Standard Malleable Iron Detachable Chain. Malleable and Steel bushed chains with or without rollers. Special chains for Conveying, Elevating or Power Transmitting Purposes.

BUCKETS

We carry a large stock of standard size and weight Salem, Seamless Steel and Malleable Buckets. We are equipped to make special Buckets of all kinds to order.



CHILLED RIM SPROCKETS

The life of the Chilled Rim sprocket is from Three to Five times that of the ordinary grey iron sprocket. Traction wheels and special sprockets furnished.



GEARS

We can furnish gears with cast Teeth Machine Molded or Machine Cut. We have the most complete equipment in the country for machine molding gears. Spurs, Bevels, Miters, Worms, Worm Wheels and Mortise Wheels.

We are prepared to furnish sheet steel conveyor troughs, hoppers, elevator casings, spouting, etc.

For a complete list of our line see a copy of our No. 38 catalogue. 800 pages of useful information to every engineer, designer, plant owner or superintendent.



THE CONVEYING WEIGHER CO.

90 WEST STREET, NEW YORK, N. Y.

AGENCIES: HERBERT AINSWORTH, Esq., The Corner House, JOHANNESBURG, S. AFRICA
THE A. M. ELLICOTT Co., 301 St. James Street, MONTREAL, CANADA
MR. FRANK R. PERROT, Aberdeen House, 204 Clarence St., SYDNEY, N. S. W.
MR. LUCIEN HERMANN, London Wall Bldg., LONDON, ENO.
VICTOR M. BRASCHI MACHINERY COMPANY, MEXICO CITY, MEX.
ZIMMER CONVEYOR COMPANY, 82 Mark Lane, LONDON, E. C., ENO.
STIMPSON EQUIPMENT COMPANY, SALT LAKE CITY, UTAH

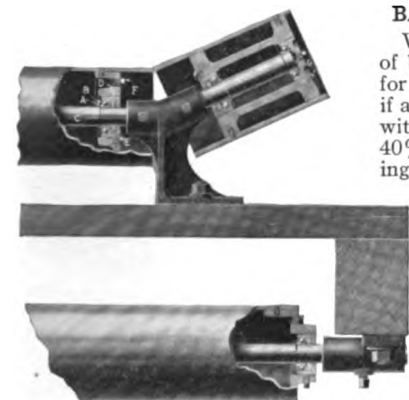
Ball Bearing Belt Conveyors; Continuous, Automatic Scales for Belt and Other Conveyors; Conveying and Hoisting Machinery; Complete Material Handling Plants; Trump Measuring and Mixing Machines; Trump Concrete Mixers

BALL BEARING BELT CONVEYORS

We illustrate herewith the construction of ball bearing troughing and return idlers for belt conveyors. It is guaranteed that if a belt conveyor running level be equipped with these idlers, there will be a saving of 40% in power required. These idlers having felt oil-retaining washers need to be lubricated only once in two years.

- A Hardened steel "Cone" fitted on turned steel shaft
- B Pressed steel "Ball Retainer"
- C Turned steel shaft, set screwed in Idler brackets
- D Oiled washer of felt or carded wool
- E Hardened steel "Plug" screwed into pulley hub
- F Brass plug for lubrication
- G Lock screw to prevent hardened plug from turning

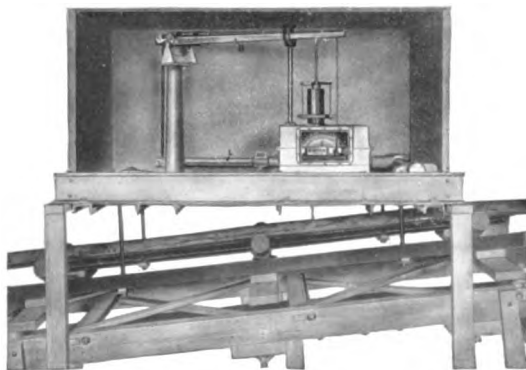
175



"Conweigh" Ball Bearing, Troughing and Return Idlers for Belt Conveyors (Patents Pending)

THE MERRICK CONVEYING WEIGHER

This device records the weight of material handled on belt conveyors, bucket conveyor, cable railways and overhead trolleys or telfhers. The weigher consists of a pair of weighing levers and a steelyard of special design so that a short section of the conveyor can be suspended from the weighing levers. The extreme end of the steelyard is connected with a totalizing mechanical integrator which derives its other factor from the travel of the conveyor by means of suitable gearing from a bend pulley on the return belt, or a sprocket wheel if on a bucket conveyor. This integrator continuously totalizes the product of two quantities, one proportional to the weight of material suspended and the other to the travel of this material. The result therefore represents the total weight of material and is plainly indicated by a register.



View of Conveyor Weigher. Front Sheet of Casing Removed

CHAIN BELT COMPANY

Established 1891

734 PARK ST., MILWAUKEE, WIS.

Manufacturers of Elevating and Conveying Machinery and Concrete Mixers

The Chain Belt Company has been manufacturing Malleable Iron and Steel Chain Belt and Sprocket Wheels for industrial purposes for twenty-five years. In addition they manufacture Chain Belt and Rex Concrete Mixers, Elevating and Conveying Machinery, Set Collars, Pillow Blocks, Couplings and other transmission appliances.

GRIPLOCK CHAIN BELT

was designed due to the fact that users of Chain Belt demanded a malleable iron Chain Belt that was *stronger, lighter*

in weight, requiring the *minimum amount of power to operate* and possessing *longer wearing qualities* than the ordinary malleable iron Chain Belt. It has the famous dirt-proof Griplock joints, the feature of these being that the wear is largely removed from the pins and transferred to the barrel and Griplock joint. Griplock is made in many sizes and styles. Catalog No. 56-S sent on request.



Griplock Roller Chain Belt



Chabelco All Steel Chain Belt

CHABELCO CHAIN BELT

is an all-steel Chain Belt designed for the severest kind of service. It is made in about seventy-five sizes and styles and was designed primarily for drives but may be used also to advantage for elevating and conveying pur-

poses. The side bars of Chabelco are made of special analysis carbon steel. Rollers are made of cold-rolled steel. Bushings are stamped out of cold-rolled, pickled steel and pins are made of forged steel. All pins and bushings are case-hardened and are tested individually by the scleroscope which is the standard instrument for testing hardness. Catalog No. 54-S sent on request.

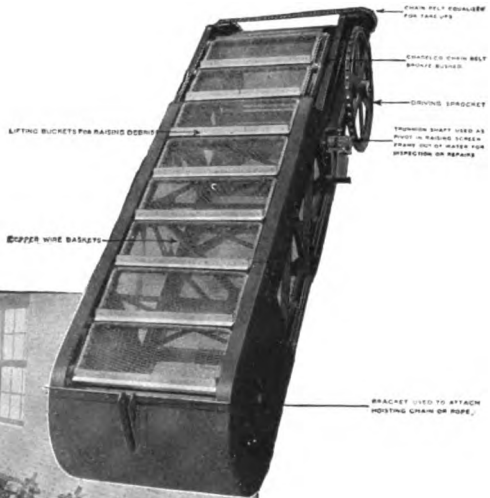
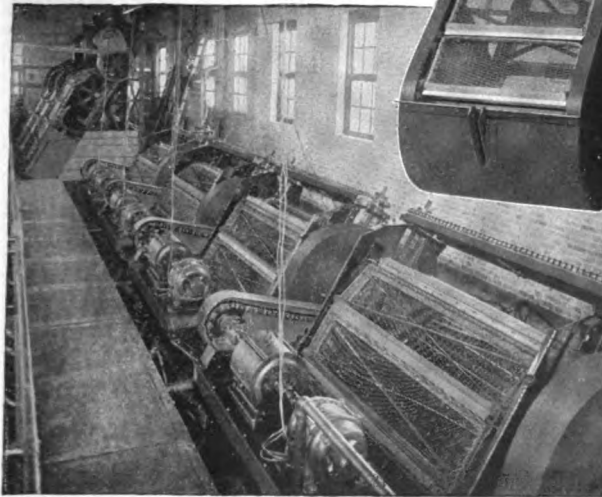
CHAIN BELT COMPANY

Established 1891

734 PARK ST., MILWAUKEE, WIS.

Pioneer Manufacturers of Chain Belt Traveling Water Screens

Battery of Chain Belt
Traveling Water Screens
in Use at the Northwest
Station of Commonwealth
Edison Co., Chicago, Ill.



Three units in-
stalled in 1911.
Four more units
installed in 1915.

CHAIN BELT TRAVELING WATER SCREENS

remove debris or foreign matter from water used in industrial plants and are especially designed to screen the large volume of water necessary in power plants. The screens are built in units or batteries of units and are made to conform to local conditions. Practically no attention is required after installation as the screens are self-cleaning. The Chain Belt Company will gladly furnish complete information and Special Bulletin No. 64-S upon request.



LINK-BELT COMPANY

PHILADELPHIA

CHICAGO

INDIANAPOLIS

**Manufacturers of Elevating and Conveying Machinery for Every Purpose.
Power Transmission Machinery**

Original Ewart Link-Belt, >Flint-Rim< Sprocket Wheels, Manganese Chains, Link-Belt Silent Chain Drives, Power Transmission Machinery, Pillow Blocks, Friction Clutches.

Power House Equipment: Peck Carriers, Belt Conveyors, Coal Bunkers, Crushers, Chutes, Telescoping Ashes Elevators.

Bridge Tramways, Locomotive and Gantry Cranes, Telfers, Electric Hoists, etc. Coal Storage Plants, Wholesale and Retail Coal Yards, Coal Tipples, Coal Washeries, Centrifugal Coal Driers, Car Hauls, Crushers, Screens, Picking Tables, Chutes, etc.

Locomotive Coaling Stations, Cinder Stations, Complete Freight Handling Equipments.

Package Handling Machinery, Store Service Conveyors.

Portable Wagon and Truck Loaders, Portable Bag and Box Piling Machines.



Chains of All Types for Elevating, Conveying and Transmitting Power

Cast Iron Gearing



>Flint-Rim< Sprocket for Durability and Service



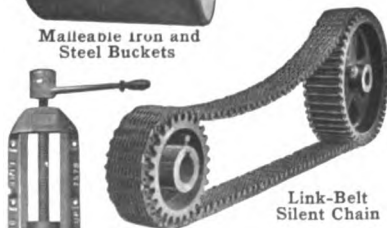
Crushers for Coal, Coke, etc.



Friction Clutches



Malleable Iron and Steel Buckets



Link-Belt Silent Chain



Elevator Boots



Bucket Elevators



Take-Ups



Protected Screw Type Take-Ups



Angle Boxes



BROWN PORTABLE ELEVATOR CO.

MAIN OFFICE AND WORKS: CHICAGO, ILL.

WESTERN OFFICE AND WORKS: PORTLAND, ORE.

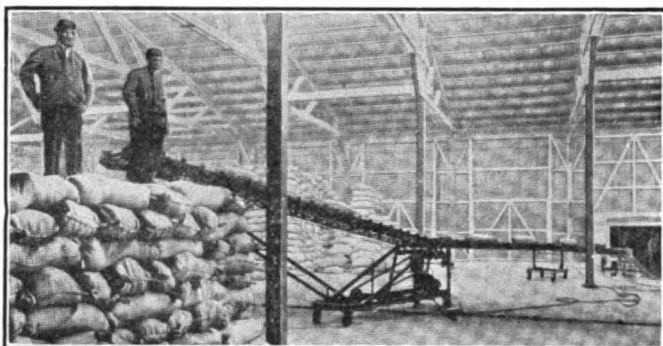
NEW YORK

PHILADELPHIA

SAN FRANCISCO

Sales Representatives in All Important Foreign Countries

**PORTABLE and SECTIONAL
ELEVATORS—CONVEYORS—UNLOADERS
for the Economic Handling of Packed Materials**



"B-P" installation, consisting of Conveyor in two sections, with Unloading Section at one end extending into boat, and Piling Section at delivery end. Takes packages from hold of boat, across warehouse, to top of pile, without intermediate hand labor—reduces costs 50%, reduces time, overcomes confusion of truckers, and makes valuable hitherto wasted air space.

179

"Brown-Portable" Machines are built to load or unload Wagons, Cars or Boats—to pile to any height in warehouse or in the open—to elevate goods to upper floors in warehouses—to convey packed goods in warehouses, mills and industrial plants. All "Brown-Portable" Machines are "MADE TO FIT THE JOB."

Their Elasticity provides for every transportation condition and requirement.

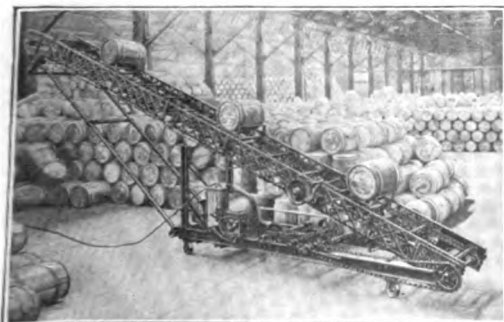
Their Portability facilitates their speedy removal from place to place.

Their Adaptability to the conditions of each establishment is provided for.

CAPACITY: A Ton a Minute. POWER: Electric, Gasoline, Steam or Air.

BAGS—BALES—BOXES—BARRELS—BUNDLES—BULK

Conveyed and Piled at one-half the expense of any other method.



GOLD MEDAL
Panama-Pacific Exposition
San Francisco, 1915

Ask for Descriptive Bulletin No 40

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316 Rialto Bldg.

Designers and Manufacturers of Standard and Special Elevating, Conveying and Power Transmission Machinery

WELLER-MADE

ELEVATING, CONVEYING AND POWER TRANSMITTING MACHINERY

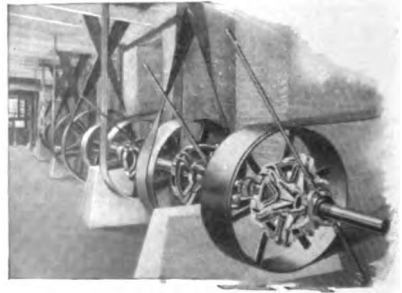
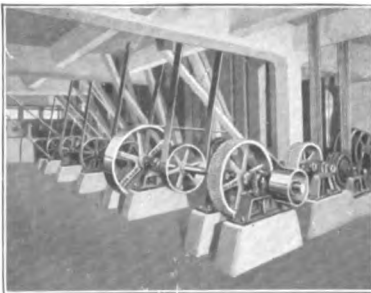
for

Cement Mills, Stone and Ore Crushing Plants
Coal Handling Systems, Sand and Gravel Washeries,
Fertilizer and Phosphate Mills,
Grain Elevators and Flour Mills,
Cotton Oil and Cotton Mills,
Starch and Glucose Factories,
Tanneries, Brick Yards, Glass Plants,
Canneries, Paper Mills, etc.

Every member of The American Society of Mechanical Engineers should have our Catalogue:

N-40 General Catalogue on Elevating, Conveying and Power Transmitting Machinery.

The most complete volume ever published on this subject.



HEAVY LINE SHAFT EQUIPMENTS

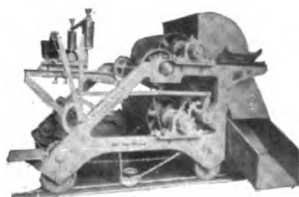
Mounted on Iron Floor Stands

Every Pulley Fitted with Friction Clutch

WELLER MANUFACTURING CO.



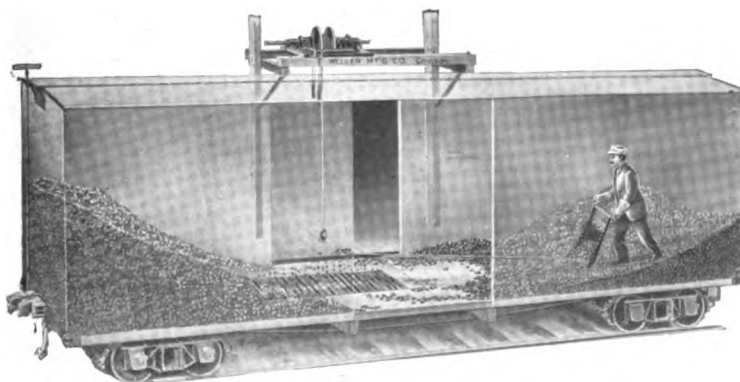
BELT CONVEYORS, 10" to 60" wide



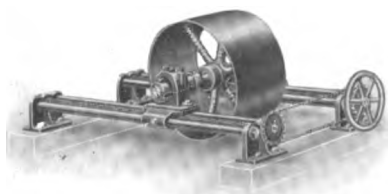
HEAVY DUTY BELT TRIPPERS



HEAVY BUCKET ELEVATORS
Up to 84" width and 36" pitch



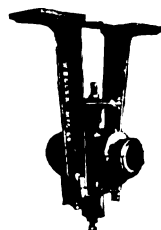
AUTOMATIC POWER SHOVELS
For unloading coal, ore, clay, sand, salt, cement, grain and other loose material



BELT TIGHTENERS



PILLOW BLOCKS
Adjustable Ball and
Socket Drop Hangers
and Pillow Blocks

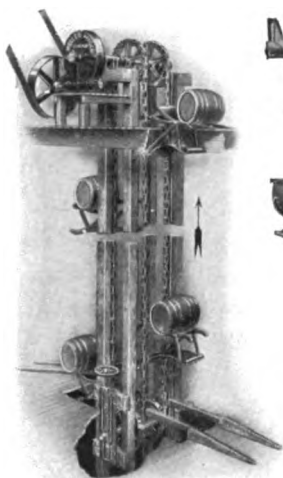


HANGERS

(Continued on next page)

(Continued from preceding pages)

WELLER MANUFACTURING CO. CHICAGO



BARREL OR SACK ELEVATOR
Elevates and lowers goods at
same time automatically delivering
on either up or down run



COLD-ROLLED SCREW CONVEYOR



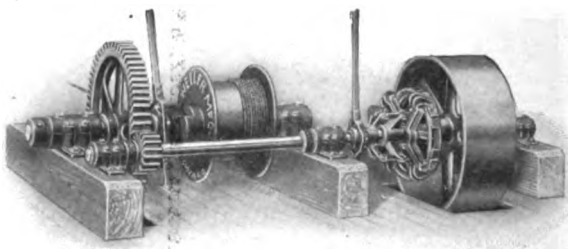
STEEL CONVEYOR BOXES



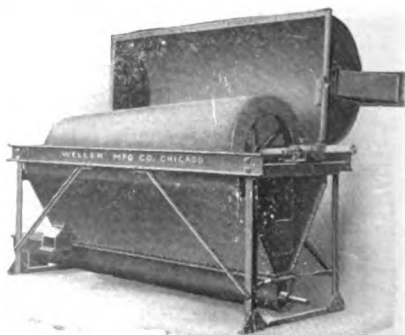
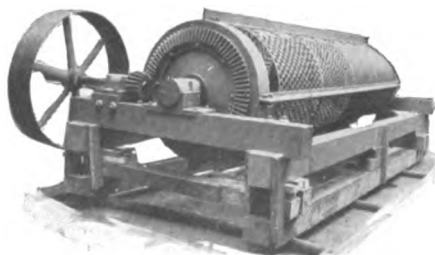
ELEVATOR CASINGS
Of any design to
suit any require-
ments



TRADE MARK



CAR PULLERS
For handling from 1 to 50 loaded cars



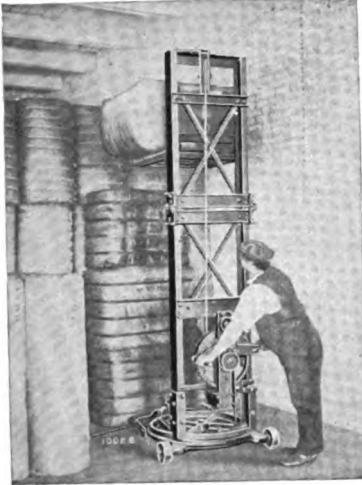
REVOLVING SCREENS, OPEN OR ENCLOSED

N. Y. REVOLVING PORTABLE ELEVATOR COMPANY

343-351 GARFIELD AVE., JERSEY CITY, N. J.

Manufacturers of the "Revolutor" Portable Elevators, Tying Machines, Case Lifters, Etc.

THE "REVOLUTOR"
REG U S. PAT. OFF.



A REVOLUTOR is a portable elevator, tying machine, case piler, stacker or lift. It consists of a *revolving base*, two uprights or elevator guides, and an elevating platform, operated by a strongly built and well-designed raising and lowering mechanism. The unit is mounted on strong truck and wheels equipped with floor lock.

What It Does

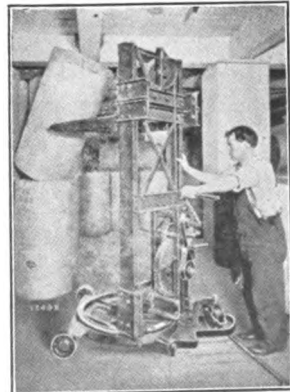
The Revolutor tiers or stacks heavy, bulky or fragile articles in any desired position, at any height and in the safest manner possible. It makes possible the use of every available cubic foot of space from floor to ceiling for storing. With a Revolutor but two, and at most three men, are required for handling the heaviest materials.

What Makes It Valuable

The big feature is the revolving base, by which the whole machine is swung around on its ball-bearing center, while the lower half of the base or truck remains stationary on the floor. With the truck base anchored firmly to the floor in any position, the platform can be loaded from any desired direction and revolved about on its revolving base like a turntable to any desired position and unloaded.

It is the revolving feature that makes it possible to tier against the walls, at the end of aisles, and to elevate large, heavy articles in narrow aisles to the point to which they are to be tiered and then revolved to an advantageous position for unloading.

Revolutors and Portable Elevators of the Non-Revolving Type are made in sizes from 5 to 20 feet in height, prices \$125.00 up.



THE LAMSON COMPANY

GENERAL OFFICES

100 BOYLSTON ST., BOSTON, MASS.

REPRESENTATIVES IN ALL
PRINCIPAL CITIES

WORKS
LOWELL, MASS. TORONTO, CANADA

Builders of Pneumatic, Selective and Mechanical Carrier and Conveyor Apparatus

Products.—Pneumatic Tube Systems, Foot-Power Tubes, Selective Pick-Up and Sweep-Off Carriers, Automatic Tray Conveyors, Belt Conveyors, Gravity Roller Conveyors, Light Elevators and Lifts, Electric Cable and Wire Line Cash and Parcel Carriers.

Scope of Use.—Used in stores, offices, factories, libraries, banks, hotels, post offices, warehouses, freight yards, etc., for the conveyance of money, papers, merchandise, mail, and materials between departments or buildings. Over three hundred different lines of business are using Lamson equipment with profit and satisfaction.

Co-operative Service.—Architects, engineers and contractors are invited to avail themselves of Lamson experience and service. Engineers employed by this company are constantly solving complicated conveying problems and are in a position to apply Lamson Service to its best advantage. Full information and plans, covering any problem to which Lamson Carriers and Conveyors may be adapted, gladly furnished without charge.

Lamson Systems.—Lamson Systems cover the following types, and with their modifications can be made to suit any problem:

PNEUMATIC TUBE SYSTEMS.—Consist of tubes, terminals and carriers operated by vacuum or pressure supplied through special power equipment. System, rapid intercommunication and delivery of papers, cash, etc., to a central point by special carriers, which are placed in the tubes and automatically carried to points of delivery. This System is designed in the following types:

Independent Lines.—Consist of two tubes connecting two stations. Carriers may be sent in either direction. No lids to open or levers to manipulate at central desk. Carriers are taken from operator's hand by suction at bell mouth.

Combination (Shifting Current) Line.—Two or more out-stations may be intermittently operated by vacuum of a single ingoing line. Speed of carriers is the same as Independent Lines. All carriers are sent to central desk regardless of others in transit.

Vacuo-Pressure Start and Stop Tubes.—Built in units. Each unit a circuit reaching from two to eight out-stations. Motor remains idle until carrier is put in tube at any sending point, when it automatically starts, and stops only after carrier arrives at destination.

LAMSON PATENT PICK-UP AND DELIVERY CARRIERS.—Traveling metal fingers or clips, which move on an endless wire, are arranged to pick up and deliver envelopes or single sheets automatically to indicated stations. (Fig. 2.)

LAMSON AUTOMATIC TRAY CONVEYORS.—Consists of a line operated by endless cable traveling about 75 feet per minute. (Fig. 3.)

BELT CONVEYOR.—Designed in conjunction with gravity chutes and elevators. Will handle boxes and packing cases, mail, etc. (Fig. 4, also Fig. 7.) *For heavy loads, Lamson Gravity Roller Conveyors are recommended.*

LAMSON GRAVITY CONVEYOR.—Consists of a series of rollers mounted on Ball Bearings carried in Angle Iron Frames. The Conveyor is inclined so that boxes, barrels or other packages, placed upon it, will be carried by gravity from place to place. Gravity Conveyors use no power, are always ready to carry a package and require no care or attention. (Fig. 6.)

LIGHT ELEVATORS AND LIFTS.—Hand, hydraulic and electrically operated. Made for simple, light delivery or varied heavy service. (Fig. 9.)



Fig. 1. Lamson Patent Combination Shifting Current Vacuum Tube Construction

THE LAMSON COMPANY



Fig. 2. Lamson Pneumatic Tubes and Pick-up System Installed in a Bank

Pneumatic Tubes provide quick communication, save time in sending correspondence, orders, blueprints, etc., from place to place. Each system designed to fit individual needs.



Fig. 5. Lamson Foot-Power Tubes

For lines about 200 feet in length. One pressure of the foot sends carrier 75 feet horizontally or raises it 40 to 50 feet vertically. Made in 2 1/4" and 3" tubing.



Fig. 6. Lamson Gravity Conveyors in a Shoe Warehouse.
Lamson Gravity Roller Conveyors save time in handling boxes, barrels and other packages. These Conveyors may be run around corners, between floors, in fact, wherever desired.



Fig. 3. Lamson Automatic Tray Conveyors

Constantly moving metal fingers quickly pick up tools, stock, parts, documents, books and small loads of all kinds from one tray or station and deliver where desired. Made in sizes to fit special requirements. Automatic in action.



Fig. 4. Lamson Belt Conveyors in Hat Factory

For moving merchandise of all sorts and loads of materials in raw, unfinished and finished stages, from place to place. Lamson Belt Conveyor systems designed to fit special conditions in each business.



Fig. 7. Lamson Parcel Belt Conveyor in Department Store

Lamson Conveyors save time in collection and delivery of packages. Enable parcels from various floors to be placed in delivery trucks and wagons in shortest time with least expense. Designed to meet needs of each individual store.



Fig. 8. Lamson Pneumatic Tubes Installed in a Factory

In many prominent factories a central planning department is connected by Lamson Pneumatic Tubes with all manufacturing departments. Orders are transmitted without loss of time and the manufacturing operations are greatly facilitated.



Fig. 9. Lamson Double Elevator
Types range from light hand-operated to hydraulic and electric. Made to meet any type of service required.

C. W. HUNT COMPANY, INC.

WEST NEW BRIGHTON, STATEN ISLAND, NEW YORK

New York City Office: 61 Broadway

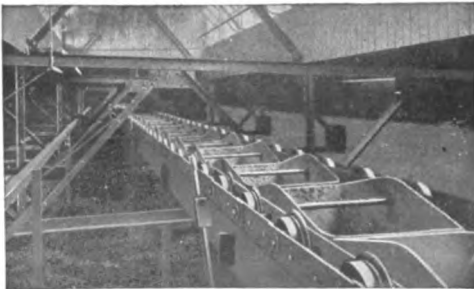
Manufacturers of Coal and Ash Handling Machinery, Pivoted Bucket Conveyors, Hoisting and Conveying Machinery, Cable and Automatic Railways, Steeple Towers, Skip Hoists, Industrial Railway Equipments, Electric Locomotives, Motor Cars, Storage Battery Industrial Trucks, Transmission and Hoisting Rope, Special Scales and Weighing Hoppers, Coal Crackers



Single Door Charging Car



Storage Battery Industrial Truck



Hunt Conveyor over Coal Bunker

INDUSTRIAL RAILWAYS AND CARS

The boiler room cars for bringing coal to boilers are so designed that the labor of firing is reduced to a minimum, and the boiler room is kept clean. We design all types of cars for use in foundries, machine shops and all kinds of manufacturing plants. The use of outside flanged wheels permits one man to push a one-ton load on a sharp curve.

Ask for catalog U-12-1 on "Industrial Railways."

STORAGE BATTERY INDUSTRIAL TRUCK

The Storage Battery Industrial Truck is designed to take the place of hand trucks, has a capacity from 2000 to 4000 lbs.; is simple and reliable.

Catalog U-14-1 on request.

PIVOTED BUCKET CONVEYORS

consist of a series of independent swinging buckets free to dump in either direction. Conveyors can run in any direction, the buckets hanging in an upright position, therefore dry or liquid material can be handled. The peculiar system of driving by a pawl relieves the conveyor wheels of all stress.



Ask for catalog U-15-4 on "Conveyors."

C. W. HUNT COMPANY, INC.

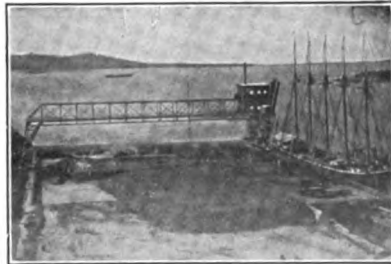
HUNT STEEPLE TOWERS

are designed to be operated by one engineer. One engine is required for hoisting the steam shovel and another for running the trolley on the booms. Great speed makes these outfits especially suited to rapid unloading of vessels. The projecting booms are usually hinged to swing horizontally over the wharf. Where obstructions such as the rigging of vessels interfere the booms can fold up in a vertical plane. Capacity of buckets ranges from $\frac{1}{2}$ to $2\frac{1}{2}$ tons.



Hunt Steeple Towers

HUNT TRANSPORTING BRIDGES are adapted to the storage and reclaiming of coal over large areas. The one shown has a four-drum equalizing engine and operates with grab buckets at a capacity of 120 tons per hour. Furnished in capacities up to 600 tons per hour.



Hunt Transporting Bridges

INCLINED BOOM HOISTING ELEVATORS

are for rapid and economical hoisting of materials from vessels. The bucket, whether large or small, is carried from the hold of the vessel to the dumping place every trip in exactly the same course, and at any rapidity demanded. The bucket is carried exactly where wanted, rising vertically from the hold to the boom, running up the boom, and dumping at a fixed place.



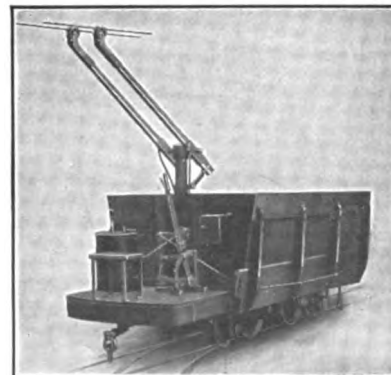
Inclined Boom Hoisting Elevators

These elevators are proportioned to suit the work and for use either with tubs or grab buckets. The lighter size is especially adapted for coal or ore hoisting, using any size bucket up to one-ton capacity.

HUNT MOTOR CARS

Self-Dumping

made in many types, capacities up to 10 tons, and are equipped with motors and overhead trolleys or shoes for third rail as desired. Suitable for transporting coal, fertilizer materials, ores, and other bulk materials.



Hunt Motor Cars
Self-Dumping

General catalog U-102 on request.

THE ALLIANCE MACHINE CO.

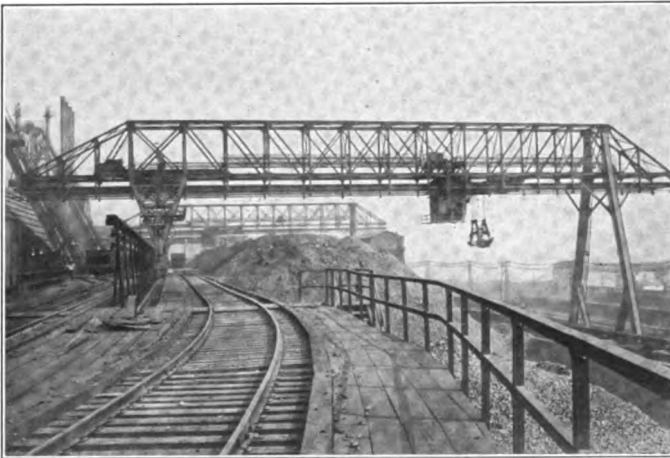
ALLIANCE, OHIO

PITTSBURGH

BIRMINGHAM

Engineers and Builders of Electric Traveling Cranes and Machines of All Types for All Purposes; I-Beam Hoists; Ore Bridges; Rolling Mill and Hydraulic Machinery, Riveters, Steam Hammers, Heavy Punches and Shears; Coke Plant Machinery, Scale Cars and Charging Larries; Copper Converting Machinery

ORE BRIDGES



The above illustration shows two Ore Handling Bridges designed and furnished by us for the Pittsburgh Steel Company. These bridges are the fastest and most efficient ever placed in operation. We have recently installed practically a duplicate of these bridges for the Pennsylvania Steel Company at Steelton, Pa. Ask us for information regarding their handling capacity.

ELECTRIC TRAVELING CRANES AND MACHINES

We have built:

The largest single trolley crane, 200 tons' capacity.

The largest ladle crane, 175 tons' capacity.

The largest stripper crane, 320 tons' capacity.

The largest high type soaking pit crane, 25 tons' capacity.

The largest slab charging crane.



INDUSTRIAL WORKS

BAY CITY, MICH.

BRANCH OFFICES: **NEW YORK**, 50 Church St.; **PHILADELPHIA**, Widener Bldg.
Agencies in Principal Cities

Builders of Locomotive, Erection and Wrecking Cranes; Gasoline Coaling Cranes; Pillar Cranes; Transfer Cranes; Pile Drivers; Transfer Tables; Portable Rail Saws; Grab Buckets; Lifting Magnets; and Pile Driver Steam Hammers

INDUSTRIAL WORKS was founded in 1873 and Industrial Works Cranes of to-day are the development of over forty-three years' experience. Satisfactory service under widely varied conditions of service has proved that they are fundamentally correct in design, sturdy in construction and efficient in operation. In size they range from 2-ton hand operated cranes to wrecking cranes of 160 tons capacity.

Locomotive Cranes.—Industrial Works Cranes, steam-, gasoline- or electrically operated, are made in capacities of from 5 to 60 tons, and with booms from 20 to 125 ft. long. They are mounted on four- or eight-wheel cars for standard or special gauge track, or on boats and gantries. Being self-propelling, they can switch several loaded cars. These cranes may be used with grab buckets, hook and block, lifting magnets, or arranged for operating with a drag-line bucket, pile-driver leads, or a steam-shovel dipper arm.

Mechanically, Industrial Works Cranes are not excelled. Every essential part of the entire crane is made, assembled and tested in our own extensive shops. All parts of the crane are accessible for easy examination, a large man being able to pass through the machinery part and car to the ground. Absolute interchangeability of parts is assured by the use of jigs and templates at every possible point in the construction. Inconvenient bearings are lubricated through oil pipes. The propelling gears on 8-wheel cars are placed in or out of mesh from the outside of the car body. For clam-shell bucket work, both drums are independent and the auxiliary take-up drum for the holding line is automatic in its action, requiring no attention from the operator.

Data.—In general all sizes of locomotive cranes do the same kind of work, the amounts being limited, of course, by their capacities. The 60-ton capacity cranes are used chiefly for erection purposes; those from 20 to 40 tons for erection work or for handling large quantities of material with a bucket or magnet; cranes from 5 to 20 tons are general purpose machines, and are in general use for all kinds of loading and placing of material.

Locomotive cranes are usually rated according to their maximum capacity at the minimum radius (about 12 ft.). The table gives the approximate radius in feet at which various size cranes will handle clam-shell buckets full of coal and sand. (A $1\frac{1}{2}$ -cu. yd. bucket holds approximately one ton of coal.)

	1½-Yd. Bucket						2-Yd. Bucket		
	5-ton	10-ton	12-ton	15-ton	20-ton		25-ton	30-ton	40-ton
Coal	20-25	30-33	34-37	41-46	48-52		49-52	52-54	58-61
Sand	18-22	26-29	30-33	36-41	44-48		37-41	42-46	47-51

To unload material with a grab bucket from the far end of a modern gondola car standing on the same track as the crane requires a 50-ft. boom. In general, the shorter the boom, the easier and faster will be the operation of the crane.



CLYDE IRON WORKS

29th AVENUE WEST, AND MICHIGAN ST., DULUTH, MINN.

Manufacturers of Hoisting Engines, Derricks and Derrick Fittings, Electric Hoists, Belt-Driven Hoists, Automatic Buckets

HOISTING ENGINES AND BOILERS OF CLYDE-GRADE

Our product is used for all kinds of Contractor's work, Dredging, Pile Driving, Railroad and Bridge Building, Quarries and general hoisting purposes. We also make a specialty of engines for skidding and loading logs, and for general logging operations.

All our engines are thoroughly tested under steam as well as by the usual hydrostatic test. All parts are made from standard jigs and templates and are absolutely interchangeable.

ONE, TWO, THREE, AND FOUR DRUM HOISTING ENGINES

In our 235-page catalog we illustrate the 2099 types and sizes of our standard engines with single or multiple drums, and single or double cylinders. These hoisting engines are regularly built with or without boiler, winch and sheave heads, and reversing gear. Clyde hoists of 7 x 10 and larger are built with all-steel gears.

DERRICKS AND DERRICK FITTINGS

In this large catalog we also illustrate and list a complete line of timber derricks and fittings. All usual conditions can be met with some one of our standard styles, but we are prepared to build derricks for any special conditions that may arise. For this purpose we maintain a force of draftsmen and engineers who are specialists in this line, and their experience of many years is at the disposal of our customers.

Clyde Derricks are designed with great care to withstand violent strains. Every possible point of weakness, both in the fittings and in their action on the timbers, has been guarded against and we claim our fittings to be the strongest on the market for the size of timbers for which they are intended.

Following is a partial list of our standard styles of derricks:

Standard Guy Derricks
Half Hand Power Guy Derricks
Hand Power Guy Derricks
Clam Shell Guy Derricks
Standard Stiff Leg Derricks
Half Hand Power Stiff Leg Derricks

Hand Power Stiff Leg Derricks
Clam Shell Stiff Leg Derricks
Full Circle Stiff Leg Derricks
Self-Propelling Derrick Cars
Self-Contained Portable Derricks
Bulletin "N" contains our new
line of All-Steel Derricks

We also manufacture a complete line of logging machinery of land-clearing machinery and of excavating machinery, including the FIELD TOWER EXCAVATOR for levee-building and drainage-canal digging.



LIDGERWOOD MANUFACTURING CO.

MAIN OFFICES

96 LIBERTY ST., NEW YORK

BRANCH OFFICES:

CHICAGO, Fisher Building
SEATTLE, 809 Western Ave.

PITTSBURGH, Union Bank Building
PHILADELPHIA, Widener Building

LONDON, ENGLAND

Manufacturers of Steam Hoisting Engines, Electric Hoists, Gasoline Hoists, Cableways, Dredging and Excavating Machinery, Logging Machinery

FOREWORD: The Lidgerwood hoisting machinery of today embodies every improvement in design and construction developed by our 43 years' experience. We have devoted ourselves exclusively to the manufacture of hoisting and hauling machinery.

It is our practice to design the complete machine to operate under the maximum service it is to perform, and to build every part of the machine to meet the full working capacity of the machine.

Every part is accurately constructed upon the duplicate part system, insuring the absolute fitting of repair parts.

We have kept pace with the development of electrical engineering, and can supply our electric hoists equipped with the latest automatic control and safety devices, and type of motor best adapted for the work to be done by the hoist.

Our friction drum hoists have cork inserted friction woods. This increases the holding power of the friction and greatly reduces the power required to apply the friction. The entire friction mechanism is extremely simple.

STEAM, ELECTRIC AND GASOLINE HOISTS for all kinds of derrick service, including grab bucket work.

STEEL DERRICKS of all types; derrick fittings for wooden derricks.

PILE DRIVING HOISTS, pile driving frames and hammers.

HIGH SPEED BUILDERS' HOISTS for operating material and hod elevators.

STEAM AND ELECTRIC HOISTS designed for shaft and tunnel work, bridge erection and to meet every requirement of contracting work.

DREDGING AND EXCAVATING MACHINERY. Steam and electric bucket and swinging engines for operating grab buckets on land and water outfits, both for dredging, and for loading and unloading sand, gravel and coal barges.

Spud engines and cutter engines for suction dredges.

Built with special regard to the severe duty such machines perform.

DRAG LINE EXCAVATORS of the revolving type, characterized by the digging quality of the bucket, the powerful engine operating same, and the strength of the entire machine consistent with its digging power.

Drag line excavators of the cableway type, with traveling towers and spans to meet the service required.

CABLEWAYS: Lidgerwood cableways, steam or electrically driven to handle loads of from one to fifty tons, with spans up to 3,000 feet and with fixed or traveling towers. They are equipped to handle plain skips, automatic dumping skips, concrete tubs, clamshell, orange peel, or scraper excavator buckets. A prominent feature is the high speed fall rope carrier.

MINE HOISTS for every character of incline haulage and mine shaft service. Steam hoists built up to 1000 H. P. and electric in any size, and fitted with complete control and safety appliances.

LOG HANDLING SYSTEMS: High speed ground and overhead log skidding systems.

RAPID UNLOADERS for unloading ballast cars.

CAR HAUL HOISTS.

INCLINE COAL HOISTS.

COAL TOWER BUCKET AND TROLLEY HOISTS.

SHIPS CARGO WINCHES.

STEERING ENGINES.

We will gladly send catalogues covering above products.



SHEPARD ELECTRIC CRANE & HOIST COMPANY

NEW YORK
PHILADELPHIA
BOSTON
PITTSBURGH

MAIN OFFICE & WORKS
MONTOUR FALLS, N. Y.

CHICAGO
SAN FRANCISCO
MONTREAL
BIRMINGHAM
LONDON, ENGLAND

Direct and Alternating Cranes and Hoists for Every Service

ELECTRIC CRANES: The Shepard Line specializes on fully developed cranes in capacities of from $\frac{1}{4}$ to 30 tons. It includes standard 3-Motor Cage Controlled Electric Traveling Cranes, Grab-bucket Cranes, Single I-Beam Cranes, Jib Cranes, Bracket Cranes, Transfer Cranes for use in combination with heavy duty Monorail Systems, and a variety of special types.

The Shepard Standard Type Crane Trolley provides oil bath lubrication, complete dirt exclusion, and permanent alignment for the gearing, brakes and motor. Gearing—Steel, Heat treated. Brakes—Multiple Disc, Standard Design.

ELECTRIC HOISTS: To meet the various handling requirements of more than eighty-five industries, many types and capacities have been developed.

Form 1 Hoist is built in capacities of from 1 to 20 tons and is furnished with plain, geared or motor driven trolley. This is the most frequently used type of hoist for runway and simple I-beam crane service.

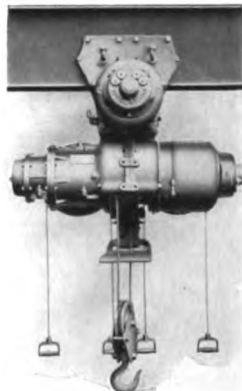
Form 2XS Hoist is a new hoist we have just developed for a field that heretofore has been covered by chain blocks. May be used for a wide variety of purposes where light loads prevail. Built in capacities of $\frac{1}{4}$ ton, $\frac{1}{2}$ ton and 1 ton, either with plain trolley or hook type, which is portable and can be utilized in many places.

Form 13 Grab Bucket Hoist employs two standard hoisting units independently controlled. Provides the most flexible and efficient means of unloading, storing and serving coal in connection with medium size power houses.

There is a Shepard Crane and Hoist specialized to meet your needs. Tell us your problem.



Form 6—Standard Type Crane Trolley



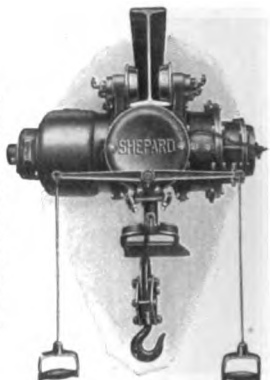
Form 1 Hoist with Motor Driven Trolley



Shepard Double Rail Track

THE SHEPARD TRACK

Its advantages are obvious in that A. S. C. E. rails having hard wearing surfaces is a distinct advantage over the soft steel I-beam. It also provides for greater effective bearing lengths in the trolley wheels. Note that punching or drilling the I-beam is unnecessary as spreader castings are placed at intervals along the runway, the bolts passing through them fastening the rails securely to the beam.

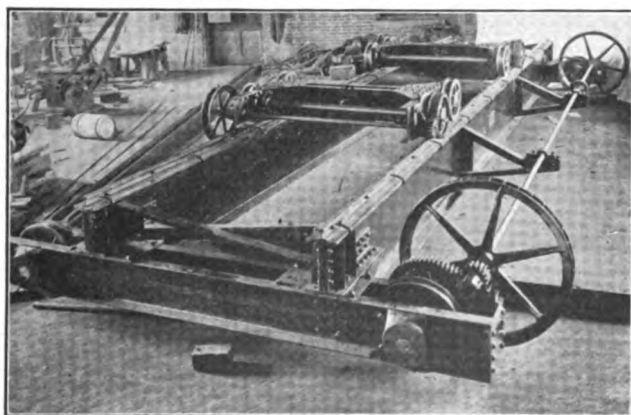


Form 2XS Hoist with Plain Trolley

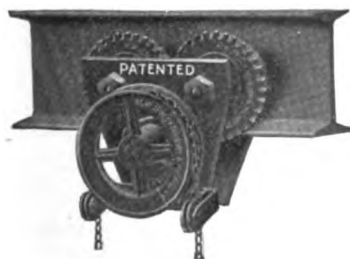
NEW JERSEY FOUNDRY & MCH. CO.

88 WEST STREET, NEW YORK

**HAND AND ELECTRIC TRAVELING CRANES
TROLLEYS, HOISTS AND MONORAIL EQUIPMENT**



193



Patented



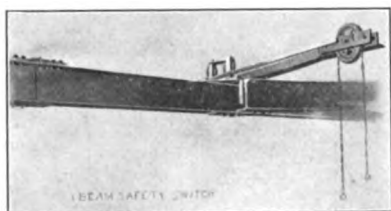
Patented

PHILADELPHIA TRAMRAIL CO.

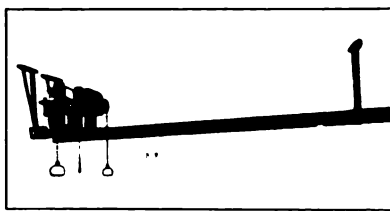
FRONT AND TUSCULUM STS., PHILADELPHIA, PA.

Manufacturers of Overhead Track Systems, Switches and Trolleys

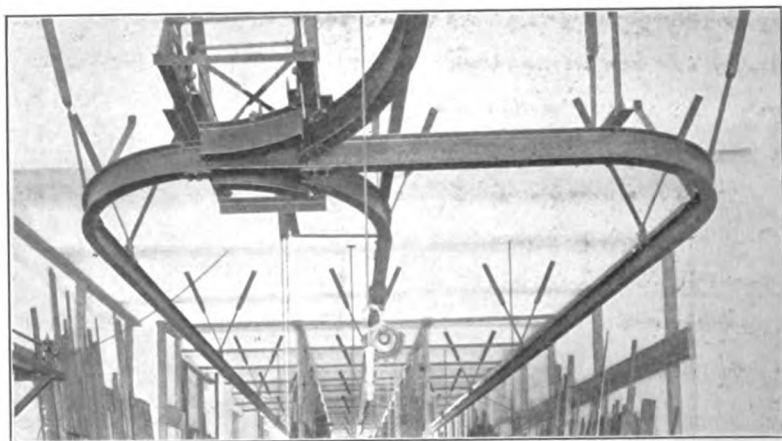
OVERHEAD TROLLEY EQUIPMENT



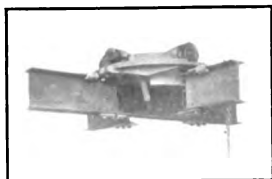
I-Beam Safety Switch



Heavy Flat Rail Safety Switch



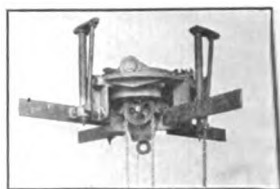
Tramrail System Showing Limit Switch



I-Beam Turntable



**Ideal Switch with
Safety Stop**



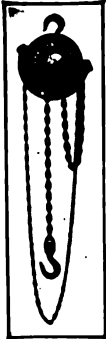
Flat Rail Turntable

We are specialists on designing and installing overhead trolley systems for conveying all kinds of materials. Catalogue on application.

FORD CHAIN BLOCK & MFG. CO.

139 WEST OXFORD STREET, PHILADELPHIA, PA.

Manufacturers of the Ford Tribloc Chain Hoist, Screw Gear Hoists, Differential Hoists and Plain and Geared Trolleys



THE FORD TRIBLOC CHAIN HOIST

The Ford Tribloc Chain Hoist is built in sizes from one-half to forty tons capacity. It is equipped with the patented Loop Hand-Chain Guide which protects the working parts, keeps the chain from gagging, and enables you to operate at any angle and at any speed you may wish to. It has steel working parts, planetary gearing (which is enclosed in a dust-proof steel case), and a $3\frac{1}{2}$ -to-1 factor of safety in its weakest part. Eighty per cent. of the power applied to the hand-chain of the Tribloc is converted into lifting energy.

PRICE LIST—TRIBLOC CHAIN HOISTS

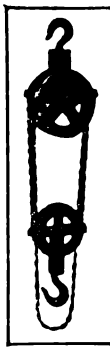
Capacity in Tons	Price Complete	Regular Hoist in Feet	Extra Hoist Price per Foot	Net Weight in Pounds	Feet of Chain Handled to Lift Load One Foot
$\frac{1}{2}$	\$35.00	8	\$0.90	53	21
1	45.00	8	.95	80	31
$1\frac{1}{2}$	60.00	8	1.00	124	35
2	70.00	9	1.05	188	42
3	90.00	10	1.50	200	69
4	110.00	10	1.60	290	84
5	140.00	12	2.15	380	126
6	165.00	12	2.15	390	126
8	200.00	12	2.70	470	168
10	240.00	12	3.25	570	210
12	300.00	12	4.30	800	126
16	360.00	12	5.40	1000	168
20	425.00	12	6.50	1375	210
32 }					
40 }					

Prices and full particulars upon request.



SCREW HOISTS (Duplex Type)

For work where the highest speed and efficiency are not required, we can furnish the Ford Duplex Type Worm Gear Hoist. This type of hoist is frequently preferred for portable use, as it is lighter in weight and at the same time powerful and durable.



DIFFERENTIAL HOISTS

This is the simplest of all chain hoists, and where a hoist is required but occasionally and high efficiency and speed are not essential, it serves the purpose admirably. The Ford Differential Hoist is made with exceeding care and of the best material obtainable.

ROLLER BEARING STEEL PLATE TROLLEYS

We carry in stock ready for immediate shipment, a line of Roller Bearing Steel Plate I-Beam Trolleys in a wide range of sizes, and in both the plain and geared types. Trolleys can be widened to suit larger than standard beams.

Send for a copy of our catalogue.
It gives prices and goes into details.



G. L. STUEBNER IRON WORKS

HANCOCK ST. AND VERNON AVE.

LONG ISLAND CITY, NEW YORK, N. Y.

Manufacturers of Hoisting Buckets, Narrow Gauge Cars, Wheelbarrows, Furnaces, Etc.



**Turn-over and Bottom Dumping
Buckets of All Types and Sizes; Steel
Skips.**



**Flat, End and Bottom Discharge
Industrial Cars and Track.**



**Push Carts for Handling Coal, Ores,
Earth, Concrete, Etc.**



**Asphalt Heaters and Lead Melting
Furnaces, Etc.**



Catalogue No. 550



**CATALOGUE SECTION
PART III**

**Raw Materials
Metals and Alloys**

197

Pages 198-210

AMERICAN BRONZE COMPANY

GENERAL OFFICES AND WORKS:

BERWYN, PENNSYLVANIA

Manufacturers of "Non-Gran" High Speed Bearing Bronze

NON-GRAN
BEARING BRONZE

TRADE MARK



FINISHED BUSHINGS

We specialize on the finishing of plain straight bushings and plain straight bushings with flange at one end.

We undertake the finishing of these two specialties in long runs only.

We do not finish any shapes other than the above two, and we finish these only when the inside diameter is two inches or less.

Oil grooves, oil holes, slots, chamfers, etc., are provided as called for.

Our standard tolerances: $\pm .0005$ " on diameters; $\pm .005$ " on overall lengths; $\pm .0025$ " on flange thicknesses. Work held to closer limits where required.

For quotations, note respective quantities on backs of your blue-prints. We furnish all necessary pattern equipment.

CASTINGS

We cast Non-Gran to any pattern of any size, with no cores, straight cores or intricate cores as required.

Use brass shrink rule and allow $\frac{1}{16}$ " stock all over for finishing on castings up to about 3"—more, in proportion, on larger castings.

On short runs we prefer to work from customers' patterns.

On long runs we prefer to make the necessary pattern equipment.

For this work we charge merely our own costs for the labor and material involved.

All Non-Gran Castings are sand-blasted and rigidly inspected before shipment.

For quotations, send patterns or sketches and state quantities.

STANDARD 12" BARS

Outside diameters $\frac{1}{2}$ " up to 5" by eighths.

Inside diameters $\frac{1}{2}$ " up to 3" by eighths.

Supplied in any combinations of the above outside and inside diameters.

Write for list of standard combinations of O. D. and I. D. which are carried in stock for immediate shipment from Berwyn or from Official Non-Gran Bar Distributors in all important cities.

Because of high tin contents Non-Gran cannot be rolled or drawn but must be cast to pattern. In ordering Non-Gran Bars therefore allow $\frac{1}{16}$ " stock all around to permit of your machining down to the finished dimensions of the part.

AMERICAN BRONZE COMPANY

POINTS TO BE CONSIDERED IN SELECTING A BEARING BRONZE

To skimp on the quality of material for the wear-subjected parts in your machines is to place a handicap on your designs and workmanship.

Will Better Bearings Prolong the First Life of Your Machines?

The first life of a machine is its life before it has to be torn down for repairs or renewals. As you analyze the construction of your machines, can you think of any parts (breakage excepted) which will require renewal before the wear-subjected, non-adjustable bearing and bushing parts? If your analysis shows that these wear-subjected, non-adjustable bushing parts are the parts which will logically give out first, it is then evident that these are the parts which determine, to the minute, the first life of the machine and it is further evident that improvement in these parts alone will lengthen this first life. A machine's first life is its best life and it is therefore good business to do what you can to prolong it.

Get a thorough understanding of what **WEAR** is so you can be your own good judge as to what metal will best resist wear.

What Is Wear?

With the aid of a microscope, you will see that the polished surface of a bearing, instead of being one solid piece as it appears to the naked eye, is, in reality, composed of billions of minute particles or molecules. Now these molecules are constantly being pulled at by the friction of the shaft revolving against them. Just as your hand would be pulled were you to hold it around a rapidly revolving shaft.

The reason a bearing wears out is because these molecules cannot resist this pull and are torn away from the billions of molecules immediately back of them. As this tearing away of molecules goes on, the inside diameter of the bearing keeps getting larger and larger until it no longer holds the shaft snug.

Whether or not a bearing will show rapid wear, depends upon the structure of the bronze and how well the constituent molecules can resist frictional pull.

Non-Gran Bronze differs from other bearing bronzes in its molecular structure. Non-Gran possesses a degree of molecular cohesion which is not approached by any other bearing bronze made. Possessing this greater molecular bond—this greater cohesion between the molecules—it is easily understood why Non-Gran Bushings outwear all others. This greater molecular cohesion means that it takes more of a pull to dislodge the molecules, and until the molecules are dislodged there is no wear.

The combined O. K. of these manufacturers should convince you of the big value in Non-Gran's strong molecular cohesion.

Evidence of Non-Gran's Quality

You will think just as much of Non-Gran as do the builders of these machines who know, by test and use, that Non-Gran is superior to any other bearing bronze on the market.

"Packard"	"Simplex"	"Saurer Trucks"	"Continental Motors"
"Locomotive"	"Case Tractors"	"Mack Trucks"	"Buda Motors"
"Marmon"	"Knox Tractors"	"Kelly Trucks"	"Hercules Motors"
"Mercer"	"Sheldon Axles"	"Federal Trucks"	"Duesenberg Motors"
"Stutz"	"Timken Axles"	"Wisconsin Motors"	"Curtiss Aeroplane Motors"

An alloy which is not uniform is not worth considering. What good is a test if results can not be duplicated? Wear-subjected parts are too vital to be doubtful—to be hit or miss. Non-Gran can not miss.

Uniformity

To give uniform bearing results, an alloy must be uniform in more ways than in merely possessing the proper ingredients in their proper proportions. Chemical analyses will show you whether or not an alloy is uniform as to its ingredients, but that, after all, only proves half the story. To give uniform bearing results, the alloy must also be uniform as to its physical properties—its molecular construction.

Variations, in the method of mixing the ingredients, in the melting temperatures, in the pouring temperatures, in the cooling time and in the hundred and one other details peculiar to the making and casting of each alloy, will in no way affect the uniformity of the alloy as regards its ingredients and their proportions, but every little such change in the handling of an alloy will immediately alter the molecular structure of the alloy and will therefore alter the bearing results to be obtained from it. Summing up the above, it is seen that chemical analysis is not all-sufficient, because it proves absolutely nothing as to the alloy's physical structure. And uniform physical structure is essential to uniform bearing results. And from the above, it is further seen that the physical structure of an alloy is altered or kept uniform by the *handling* of the alloy in its making.

From whom are you most likely to get an alloy of uniform physical structure? From men who make twenty to thirty or even just two alloys, or from an organization of men who make just one alloy and in which organization each man therefore has but the same one detailed thing to do hour after hour, day after day and week after week?

Non-Gran Bronze is the only bearing bronze made which is made by men who make nothing else. Non-Gran's strong molecular cohesion is found in every Non-Gran casting and we guarantee that Non-Gran, taking it year in and year out, is the closest approach to absolute uniformity of any non-ferrous alloy made.

The manufacturers who have been using Non-Gran Bronze for years and who never have any bushing "come backs" will vouch for the validity of the above claim.

A. ALLAN & SON

494 GREENWICH STREET

NEW YORK

Inventors and Sole Manufacturers of Allan Red Metal and Allan Bronze



ALLAN RED METAL

A lead-copper bearing alloy, one of the products of the Allan Process, whereby lead-copper and lead-copper-tin can be alloyed in any desired proportion, invented by A. Allan, Sr., in 1876. A lead-copper bearing alloy possesses qualities not common to white babbitt metals. It has an exceedingly high fusing point. The absence of adhesive qualities in this alloy makes it an anti-friction metal that will not stick to, cut or scar a pin, shaft or cylinder. Allan Red Metal is capable of meeting service conditions where steam temperatures run up to 650° Fahr.

Allan Red Metal is used as shaft packing on steam turbine units up to 25,000 K. W. It is used as piston rod and valve steam packings for locomotive service where high degrees of super-heat are used. It is used for cross head brasses, crank pin, mill pinion, motor and turbine bearings.

The worth of Allan Red Metal as a bearing alloy is assured by the fact that American engineering practice has accepted Allan Metal faced pistons as the most advanced design in piston construction. During the past twenty-five years millions of pounds of Allan Red Metal have been sold for facing both H. & L. Pressure pistons for all service conditions, both marine and stationary.

The application of this metal to pistons reduces friction and wear, keeps the cylinder in a smooth and polished condition and prevents scoring.

Our 16" x 26" Blue Print mailed free on request.

LUMEN BEARING COMPANY

BUFFALO

Brass Founders

LUMEN BRONZE (for bearings)

20% lighter than a phosphor bronze of the same bearing capacity—and
30% less expensive on a high metal market.

	Sand Cast	Chill Cast
Tensile Strength	32-36000	40-45000
Elongation	0%	0%
Brinell Hardness	114-119	119-124
Specific Gravity	6.9	
Weight per cubic inch	0.25	
Shrinkage	$\frac{1}{16}$ "	

MANGANESE BRONZE (for strength parts)

	Sand Cast	Chill Cast
Tensile Strength	72-84000	80-88000
Elongation	22%-35%	26%-32%
Brinell Hardness	109-119	124-130
Specific Gravity	8.4	
Weight per cubic inch	0.30	
Shrinkage	$\frac{1}{4}$ "	

GEAR BRONZE (for worm drives)

	Sand Cast	Chill Cast
Tensile Strength	31-35000	48-52000
Elongation	6%-10%	8%-12%
Brinell Hardness	72-77	100-105
Specific Gravity	8.5	
Weight per cubic inch	0.307	
Shrinkage	$\frac{1}{8}$ "	

PHOSPHOR BRONZE (for bearings)

	Sand Cast	Chill Cast
Tensile Strength	28-30000	40-42000
Elongation	5%-7%	3%-5%
Brinell Hardness	65-70	86-89
Specific Gravity	9.0	
Weight per cubic inch	0.33	
Shrinkage	$\frac{1}{16}$ "	

Physical data are based on test bars cast according to standard methods.

SPECIAL BRONZES

We are prepared to meet any commercial specifications and to produce in our castings the highest physical qualities consistent with any chemical formula. We maintain a fully equipped laboratory for the purpose of controlling our alloys.

To Engineers

We invite you to visit our plant at any time. Telephone Oxford 77—
address 197 Lathrop St.

UNITED LEAD COMPANY

111 BROADWAY, NEW YORK CITY

Offices in All Principal Cities

Specialists in Lead Products

LEAD WOOL

LEAD ROPE

SHEET LEAD

LEAD PIPE

TRAPS AND BENDS

TIN PIPE

LEAD, TIN, BRASS AND COPPER LINED IRON PIPE

ACID RESISTING VALVES

ULCO LEAD ROPE: For making Metallic Packing we put up Lead Rope in smaller sizes. This material is sold lubricated or not, as requested. For stuffing boxes and valve stems the lead rope should be thoroughly saturated with graphite and oil. For making gaskets it is wrapped in cheese cloth and saturated with graphite and oil.

LEAD WOOL: For calking cast iron and riveted steel pipe for gas and water mains. Since it is not necessary to heat it, it cannot shrink like a cast lead joint. Used extensively for high pressure mains.

LINED PRODUCTS: Lead, tin, brass and copper lined iron pipe—Fittings, lead and tin lined, flanged or threaded. All of this class of products lined by the United process which inseparably bonds or fuses the two metals. Let us help you figure on your Water, Acid, or Food Product piping problems. Write for catalogue.

BABBITT METALS: All lead, tin, antimony, arsenic, copper alloys for use as Bearing or Casting Metals.

Write for catalogue of the particular product in which you are interested.

"Anything Made of Lead"

AMERICAN VULCANIZED FIBRE CO.

Established 1873

WILMINGTON, DELAWARE

VULCANIZED FIBRE

Manufacture—In the manufacture of fibre there are three factors absolutely essential to mechanical strength and electrical insulation: 1. Pure Raw Material. 2. Experience and care in the process of making. 3. Freedom from chemicals in the finished product.

American Vulcanized Fibre is made from raw stock free from iron, bone or other impurities.

The processes of manufacture are accurately and scientifically controlled.

The finished product undergoes rigid chemical analysis and physical test.

As the sole makers of *Original* Vulcanized Fibre, we naturally know how to make the very finest fibre and constant endeavor produces a better and more uniformly excellent product each year.

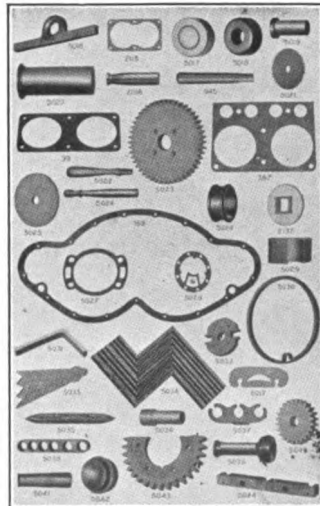
The result is a tough, homogeneous, horn-like material with the following valuable characteristics:—

Characteristics: Tensile strength 9,000–14,000 lbs. per sq. in., Compressive strength 32,000–37,000 lbs. per sq. in., Resistance to shearing 9,000–13,000 lbs. per sq. in., Specific Gravity 1.2–1.5, Electrical Rupture 150–400 volts per 1/1000 inch of thickness.

COMPARATIVE TABLE	Pounds per cu. ft.	Effect of Oil, etc.	Effect Rodents, Vermin, etc.	Brittle or Tough	Effect of Age
VULCANIZED FIBRE.....	85	None	None	Tough	Improves
Porcelain, etc.....	144	None	None	Brittle	.....
Hard Rubber.....	150	Deteriorates	.....	Brittle	Deteriorates
Rawhide, Leather, etc.....	Varies	Deteriorates	Destroy	Tough	Deteriorates

Partial List of Applications

Adjusters (Cord)	Mirror Backs
Baskets (Hop)	Packings
Baskets (Mill)	Pinions (Noiseless)
Baskets (Waste) "Vul-Cot"	Rings
Bases (Switch)	Rods
Bearings (Plain),	Rollers
Thrust, etc.)	Rolls (Pinking)
Bobbins (Coil)	Seats (Chair)
Boxes	Shims (Switch)
Bumpers (Textile)	Shoe Horns
Bushings	Shoes (Brake)
Cans (Roving)	Staples (Insulating Saddle)
Checks (Factory Time)	Straps (Brake)
Cleats	Switch Bars
Conduits (Interior)	Tacks (Insulated Wiring)
Discs (all kinds)	Tags
Ferrules (Condenser,	Telephone Cleats
Handle)	Tie Plates (Railroad)
Frames (Bolster Case)	Trucks (Mill)
Frictions	Tubes
Gaskets (Oilproof)	Valves (Pumps)
Gears (Noiseless)	Washers, (Friction, Thrust,
Gear Blanks	Insulating, Compression,
Gibs (Engine, Crossheads)	Cock, Pipe Union, Car-
Handles	riage Axle, Car Box)
Heads (Magnet, Bobbin,	Wedges (Armature)
Spool)	Wheels
Insulation	Wiring Cleats
Insulators (Rail Joint)	And many others.
Linings (Clutch) "Auto"	



A moment's thought will undoubtedly suggest to you applications not named above which will improve or cheapen your product or facilitate its manufacture.

Our Development Department is at your service to solve your problems, answer your inquiries or quote you prices, without obligating you in the slightest.

THE AMERICAN BRASS COMPANY

WATERBURY, CONNECTICUT, U. S. A.

MILLS AND FACTORIES:

ANSONIA BRASS AND COPPER BRANCH	-	-	ANSONIA, CONN.
BENEDICT AND BURNHAM BRANCH	-	-	WATERBURY, CONN.
COE BRASS BRANCH	-	-	TORRINGTON, CONN.
COE BRASS BRANCH	-	-	ANSONIA, CONN.
KENOSHA BRANCH	-	-	KENOSHA, WIS.
WATERBURY BRASS BRANCH	-	-	WATERBURY, CONN.

BRASS, COPPER, AND GERMAN SILVER

**IN EVERY VARIETY OF SHEETS, ROLLS, PLATES, WIRE AND RODS, MOULDINGS,
ANGLES AND CHANNELS, CIRCLES, BLANKS AND SHELLS**

SEAMLESS AND BRAZED TUBING

CONDENSER TUBES AND LOCOMOTIVE TUBES

TOBIN BRONZE AND PHOSPHOR BRONZE

RODS, PLATES AND SEAMLESS TUBING

EXTRUDED METAL

RODS, SPECIAL SHAPES AND PRESSED METAL PARTS

TURBINE BLADING AND CALKING STRIPS

OF BRASS OR CUPRO NICKEL

BENEDICT NICKEL WHITE METAL

SEAMLESS TUBING, SHEETS, WIRE, RODS AND INGOT

BARE AND INSULATED COPPER WIRE AND CABLES

**"K. K." WEATHERPROOF AND SLOW BURNING WIRE, ROUND AND FLAT
MAGNET WIRE**

ALUMINUM COMPANY OF AMERICA

PITTSBURGH, PA.

BRANCH OFFICES

NEW YORK, 120 Broadway

BOSTON, MASS., 131 State Street

PITTSBURGH, PA., 2423 Oliver Bldg.

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CHICAGO, ILL., 1500 Westminster Bldg.

DETROIT, MICH., 1512 Ford Bldg.

TORONTO, ONT., NORTHERN ALUMINUM CO., LTD., 1305 Traders Bank Bldg.

PIERSON, ROEDING & COMPANY, 118 New Montgomery St., SAN FRANCISCO, CAL.

ROCHESTER, N. Y., 1112 Granite Bldg.

PHILADELPHIA, PA., 1216 Widener Bldg.

KANSAS CITY, MO., 308 R. A. Long Bldg.

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Aluminum: Ingot, Casting Alloys, Sheet, Foil, Rod, Wire, Tubing, Mouldings, Fittings, Electrical Conductors, Bronze Powder and Lithograph Plates

FABRICATED ALUMINUM

Automobile hoods, fenders and stampings. Steam-jacketed kettles, tanks, pans, coils, pipe lines and miscellaneous apparatus for chemical, fruit juice and other manufacturers.

ELECTRICAL CONDUCTORS

The use of Aluminum for electrical conductors is rapidly increasing. Its properties make its use desirable in electrical construction and it is now being successfully used for High Tension Transmission Wire, Railway Feeders, Bus-Bars, etc.

PUBLICATIONS

The following publications issued by us contain much valuable information for the aluminum user and will be gladly sent to those interested:

1. PROPERTIES OF ALUMINUM
2. ALLOYS OF ALUMINUM
3. METHODS OF WORKING ALUMINUM
4. FABRICATED ALUMINUM
5. ALUMINUM ELECTRICAL CONDUCTORS
6. ALUMINUM—ITS USE IN THE BREWERY
7. STEAM-JACKETED KETTLES
8. USEFUL TABLES

THE DAVIDSON STEEL CO., INC.

MAIN OFFICE
124 MAIDEN LANE, NEW YORK

Telephone: John 2083 and 2084

MILLS: SHEFFIELD AND BIRMINGHAM, ENGLAND, AND U. S. A.

All Grades of Alloy Steel for All Purposes

We have quantities of **high speed steel** at our New York warehouse for immediate shipment.

Also

HIGH GRADE TOOL STEEL
CHROME VANADIUM
CHROME NICKEL
3½% NICKEL

Special forgings made from blue prints.

"HEHTEMND"

After years of experimenting we have produced this Chrome Nickel Vanadium steel.

It is the toughest and strongest steel made for automobile gears, pinions, axles, etc.

We guarantee this steel will machine at 100 to 170 ft. per minute with ordinary high speed steel.

It is as **non-changeable** as the best oil hardening die steels.
You **cannot break** it.

You **may finally tear** it.

Greater tensile strength and more **non-crystallizing** than Chrome Vanadium.

Greater Elasticity than nickel or chrome nickel.

Easier Machining qualities than machine steel.

Physical Qualities (Approx.)

	Annealed	Treated
Tensile Strength.....	120,000	205,000
Elastic Limit.....	98,000	170,000
Elongation.....	25%	20%
Reduction of Area.....	50%	45%
Scleroscopic Reading.....	25 soft annealed, 83 hard treated	

ELLSWORTH HARING

114-118 LIBERTY ST., NEW YORK

High Speed, Cold Rolled, Crucible and Alloy Steel. Nickel Pure, in Rods, Bars, Sheets and Wires. Resistance Wires, Various Grades

ELHAR SPECIAL HIGH SPEED STEEL is a wonderful steel for all purposes where high speed steel is used. Uniform in quality, and will stand the most severe tests.



ELHAR DOUBLE X is the highest grade HIGH SPEED STEEL made.

FORGINGS—Connecting Rods, Piston Rods, Crank Shafts, Die Blocks, Hammered Bars, etc., in all grades of steels, including Alloy Steels.

HIGH SPEED STEEL TOOL HOLDER BITS. In five and ten pound boxes. Hardened and tempered ready for use.

ELHAR EXTRA TOOL STEEL, best Carbon Steel for general use.

ELHAR SPECIAL TOOL STEEL. This is a regular tool steel for machine tools, such as cutters, dies, etc. Also taps and reamers. Very dense and tough.

SPECIAL STEELS IN DISCS, FORGINGS, ETC. Made in all Alloys.

NICKEL STEEL. 1½% to 3½%. Also 25 and 30% Nickel Steel.

SPECIAL CHROME VANADIUM STEEL for heading dies, etc.

Drill Rods and Drawn Steel for Tools, Punches, etc., High Grade drawn from Imported Rods. Hardware and Medium Grades. Drawn Steel for Needle Bars, Scale Bar Rails, Carriage Steel for Typewriters, etc. Drawn Steel for Ball Manufacturers, etc.

Chrome Steel for Ball Races.

Automobile Steel. Various Grades of Alloy Steels for Water, Air, Oil and Case Hardening—for all purposes.

Special Steel. Saw Steel, Plow Steel, Alloy Steel, Spring Steel, Shovel Steel, Crucible and O. H. Plates, Sheets, Bands.

Cold Rolled Strip Steel. High Carbon. Excellent finish. Dead soft annealed and medium hard—to take temper—can also supply this steel for various purposes in various grades.

Cold Rolled, Tempered and Polished Steels.

Magnet Steel. Various qualities.

Welding Wires. Special Iron Wire for Electric Welding, etc.

E-H Ignition Metal. Rods and sheets for Spark Points and Ignition Devices. *Send for special list.*

Nickel Rolled Anodes. For Electro Plating.

Nickel Sheets. Also Wire and Rods.

Nickel Alloy. Wire and Rods.

Resistance Wires and Metals. Send for special catalogue.

Ignition Points. Finished points made to order. Also Tungsten Ignition Points.

Balls. Brass and Bronze Balls.

Steel Balls. Highest grades absolutely accurate. Medium grade—Hardware grade.

Music Wire. For Springs, Brick Cutters, etc.

Machine Needle & Sewing Machine Wire. Highest Quality.

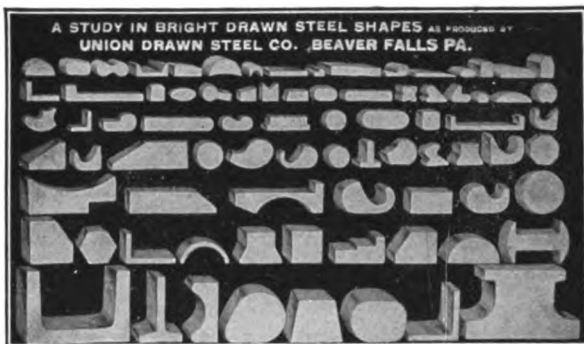
Mixer Knives. For Cutting Pulp, etc. (a specialty).

UNION DRAWN STEEL COMPANY

Works and General Office
BEAVER FALLS, PA.

WAREHOUSES: NEW YORK, PHILADELPHIA, CHICAGO, CINCINNATI, DETROIT.
BRANCH SALES OFFICES: BOSTON, BUFFALO.

Manufacturer of Bright Finished Steel Exclusively in Rounds, Squares, Hexagons, Flats and Shapes, Shafting, Screw Steel, Axle Steel, Bessemer, Open Hearth, Crucible, Nickel and Vanadiums, Drawn—Cold Rolled and Turned Steel



SPECIAL SHAPES OF COLD DRAWN STEEL of any dimensions within our range and for all purposes, will be made in the shortest possible time consistent with perfection in quality, in accordance with specifications furnished, where sufficient quantity will justify equipment.

The most comprehensive stock of Bright and Finished Steel, Rounds, Squares, Hexagons and Flats carried at our branch warehouses, in addition to the large stock we carry at our mill.

We are the largest manufacturers of cold-finished steel and iron for shafting and various machinery uses. Established 1889, but rebuilt Fireproof Plant and all new machinery installed, 1911.

SHAFTING.—We use only the best quality of soft steel and are manufacturing under recent patents, covering machinery and appliances, by a process superior to anything known for producing work mathematically accurate as to size, absolute straightness, and a perfectly polished surface.

PISTON AND PUMP RODS.—For piston and pump rods we use a special grade of steel, and can produce them strictly uniform in size and quality, highly polished, perfectly straight, and of lengths up to 60 or 70 feet.

SCREW STEEL.—For this work we furnish a special analysis of steel, which, after years of experiment, has proved best adapted to free cutting and threading, and for the production of the maximum number of parts in the minimum of time, by the use of automatic and hand-screw machines and Turret lathes.

SPECIAL STEEL.—For the various places where special grades of steel are required, our experience and facilities are such that we can promptly furnish material best adapted for the special requirements.

ELEVATOR GUIDES.—We make Cold-Drawn Steel Elevator Guides. Perfectly matched joints. Perfectly straight.

ALLOY STEELS.—Cold-Drawn Nickel, Chrome Nickel, Vanadium, Chromium and Electric Furnace Alloy Steels. Heat treated or unheat treated, for Automobile and Machinery use.

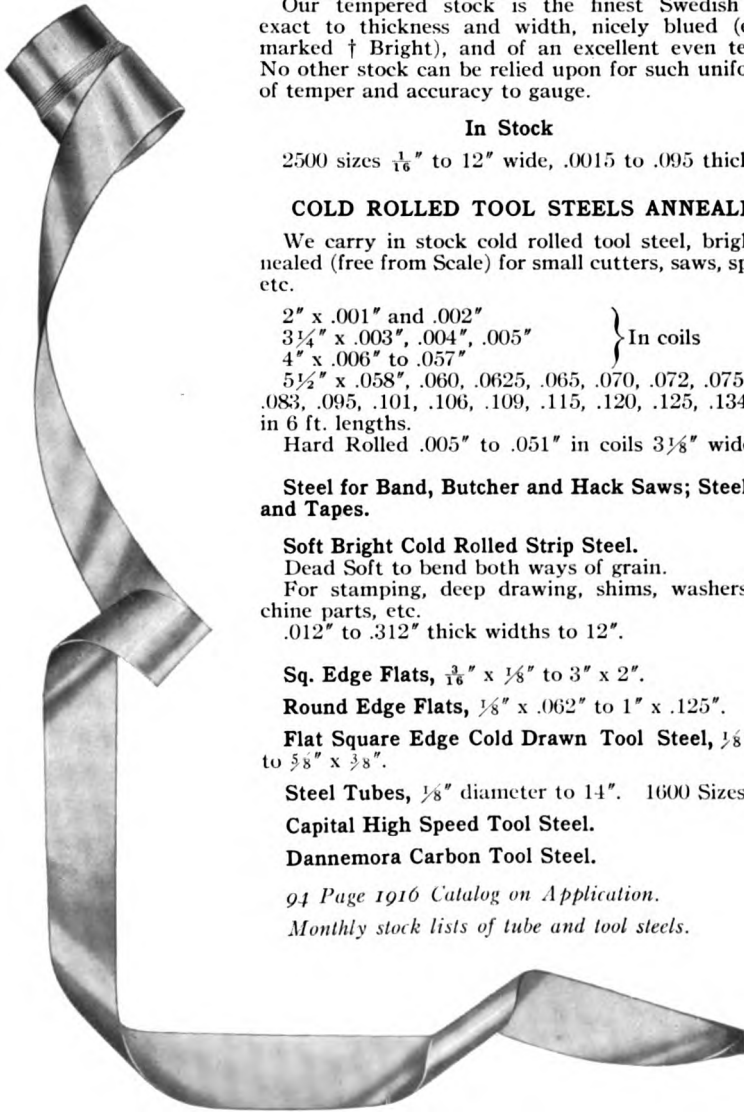


EDGAR T. WARD'S SONS

50 FARNSWORTH STREET, BOSTON, MASS.

Cold Rolled Strips, Bars, Sheets and Tubes, Tool Steels, Fine Steel Wires

HARDENED, TEMPERED, POLISHED AND BLUED STEEL STRIPS



Our tempered stock is the finest Swedish Steel exact to thickness and width, nicely blued (except marked † Bright), and of an excellent even temper. No other stock can be relied upon for such uniformity of temper and accuracy to gauge.

In Stock

2500 sizes $\frac{1}{16}$ " to 12" wide, .0015 to .095 thick.

COLD ROLLED TOOL STEELS ANNEALED

We carry in stock cold rolled tool steel, bright annealed (free from Scale) for small cutters, saws, springs, etc.

2" x .001" and .002"	} In coils
3 $\frac{1}{4}$ " x .003", .004", .005"	
4" x .006" to .057"	
5 $\frac{1}{2}$ " x .058", .060, .0625, .065, .070, .072, .075, .077, .083, .095, .101, .106, .109, .115, .120, .125, .134, .158	

in 6 ft. lengths.

Hard Rolled .005" to .051" in coils 3 $\frac{1}{8}$ " wide.

Steel for Band, Butcher and Hack Saws; Steel Pens and Tapes.

Soft Bright Cold Rolled Strip Steel.

Dead Soft to bend both ways of grain.

For stamping, deep drawing, shims, washers, machine parts, etc.

.012" to .312" thick widths to 12".

Sq. Edge Flats, $\frac{3}{16}$ " x $\frac{1}{8}$ " to 3" x 2".

Round Edge Flats, $\frac{1}{8}$ " x .062" to 1" x .125".

Flat Square Edge Cold Drawn Tool Steel, $\frac{1}{8}$ " x $\frac{1}{16}$ " to $\frac{5}{8}$ " x $\frac{3}{8}$ ".

Steel Tubes, $\frac{1}{8}$ " diameter to 14". 1600 Sizes.

Capital High Speed Tool Steel.

Dannemora Carbon Tool Steel.

94 Page 1916 Catalog on Application.

Monthly stock lists of tube and tool steels.

WHELOCK, LOVEJOY & COMPANY

NEW YORK
23 CLIFF ST.

CAMBRIDGE
128 SIDNEY ST.

Steel

Agents
THOMAS FIRTH & SONS, LTD.,
SHEFFIELD, ENG.
Cutlery and Saw Sheet Steel

FIRTH-STERLING STEEL COMPANY,
PITTSBURGH, PA.
Makers Tool Steel

Agents
GLOBE WIRE CO., LTD.,
SHARPSBURG, PA.
*Polished Drill Rods, Needle Wire
Drawn Steel in Special Shapes*
BRIGHTMAN MFG. CO.,
COLUMBUS, OHIO
*Turned, Ground and Polished
Shafting and Screw Stock*

WEST PENN STEEL CO.,
BRACKENRIDGE, PA.
Cold Rolled and Electrical Sheet Steel

HY-TEN STEEL

This steel is of high tensile strength and elastic limit, especially intended for machine tool parts where good wearing qualities combined with great strength and toughness are essential.

A complete stock is carried in warehouses for prompt shipment.

FIRTH-STERLING "BLUE CHIP" HIGH SPEED STEEL

Suitable for Lathe and Planer Tools, Milling Cutters, Drills, Reamers, Taps, Cutting and Blanking Dies, etc.

"Blue Chip" High Speed Steel is carried in stock in the following sizes and shapes:

SQUARES, $\frac{1}{4}$ in. to $\frac{5}{8}$ in. Hard Steel ready for use.

$\frac{1}{8}$ in. to 3 in. Annealed.

ROUNDS, $\frac{1}{8}$ in. to 10 in. Annealed.

FLATS, $\frac{3}{8}$ in. x $\frac{1}{8}$ in. to $5\frac{1}{2}$ in. x $\frac{7}{8}$ in. Annealed.

$\frac{1}{2}$ in. x $\frac{1}{4}$ in. to $3\frac{1}{8}$ in. x 2 in. Annealed.

Special sizes can be secured promptly from the mill.

FIRTH-STERLING TOOL STEELS

Other high grade Firth-Sterling Steels carried in stock by Wheelock, Lovejoy and Company are in part as follows:

Firth's Best Tool Steel (Water Hardening), a strictly high grade carbon tool steel for general service.

Firth-Sterling Special Steel. For Punches, Dies, Chisels, Blacksmith Tools, Shear Blades, Rivet Snaps and all Shop Work.

Sterling Tool Steel. This steel is made to compete with the lower grades on the market, and will compare favorably with them. Carried in stock in Rounds, Flats, Squares and Octagons.

ALLOY STEELS

To meet the increased demand for steels that are more effective than carbon steels, and of a different character from High Speed Steel, we have developed the following which we now recommend for various purposes:

Firth-Sterling "Extra Special" Steel

Firth-Sterling "Double Special" Steel

"Hold Fast" Magnet Steel

"C Y W Choice" Steel

"A W Special" Steel

Firth-Sterling Finis Steel

"Tool Steel for Every Purpose"

**CATALOGUE SECTION
PART IV**

**Metal Working Machinery
Machine Tools and Accessories
Shop Equipment**

211

Pages 212-270

E. W. BLISS COMPANY

19 ADAMS STREET, BROOKLYN, N. Y.

Builders of Sheet Metal Working Machinery

**PRESSES, DIES, SHEARS,
DROP HAMMERS,
DOUBLE SEAMERS,
SPECIAL MACHINERY**



**"Bliss" Inclinable
Power Press**



**"Stiles" Punching
Press**



**"Bliss" Toggle Drawing
Press**



**"Bliss" Double-Crank
Press**

The most complete line of machines for sheet metal working in the world.

Presses for every ordinary kind of work and special machines for unusual requirements. Hinge and Butt machinery, Fork and Spoon machinery, Expanded Metal Lath machinery, Shovel machinery, Horse Shoe machinery, Minting machinery, Automobile Parts machinery, Spinning Lathes, Gang Slitters, Circle Shears, Perforating, Punching, Slitting, Shearing, Beading, Flanging, Crimping and Seaming machines.

Complete equipments for the economical manufacture of Petroleum and Alcohol Cans, Fruit and Vegetable Cans (Sanitary and Packers'), Meat Cans, Paint and Varnish Cans, Lard Pails and Butter Tins, and all kinds of Tin Canisters, Boxes and Packages.

Machinery for manufacturing Soft Metal Tubes, Aluminum, and Silverware, Metal Shingles, Metal Ceilings, Sheet Metal Furniture, Kitchen Utensils, Kitchen Boilers, Oil Stoves, Lamps, etc., etc.

We are also equipped for die work of every description.



**"Bliss" Trimming
Press**

**Tin and Enamel Ware Machinery
Metal Package Machinery
Automatic Tin Can Machinery
Electrical Parts Machinery
Automobile Parts Machinery
Drop Forging Machinery**



**"Stiles" Drop
Hammer**

THE LONG & ALLSTATTER CO.

HAMILTON, OHIO, U. S. A.

Manufacturers of Power Punches and Shears

POWER PUNCHING & SHEARING MACHINERY
COPING MACHINES—STRUCTURAL PUNCHES
RIVETING MACHINES—TIRE WELDING MACHINES
ARMATURE DISC NOTCHING MACHINES
HELVE HAMMERS

One of the pioneers in their line whose tools may be found in most of the larger and more important metal-working establishments in our own country and many in Europe.

To those familiar with the trade, the name of this firm is a synonym for quality, workmanship, efficiency and durability.

PUNCHING MACHINES **SHEARING MACHINES**

A complete line of open-throated type, large and small, single- and double-ended, belt, steam or electrically driven (customer's option); a carefully graduated schedule for general purpose use, with modifications in endless variety for special work of all kinds.

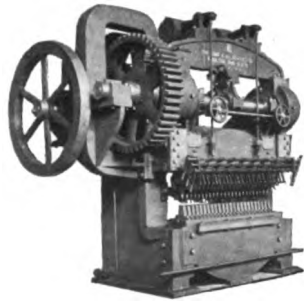
MULTIPLE PUNCHES **GATE SHEARS**

Varying in width between housings and depth of throat to suit customer's requirements; to punch any number of holes, in groups or in rows, with fixed or adjustable centers, or cut off and trim plates or sheets of any width or thickness.

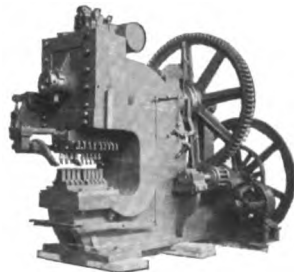
COPING MACHINES **STRUCTURAL PUNCHES**

A full line, for coping and punching large and small structural sections (beams, channels, angles, etc.) of all kinds and sizes with the widest range of equipment.

Write us regarding your problems in punching and shearing—correspondence solicited. Estimates furnished on request. If interested, you may have a catalogue for the asking.



Multiple Punch



Structural Iron Punch



Horizontal Punch and Bending Machine

NIAGARA MACHINE & TOOL WORKS

BUFFALO, N. Y., U. S. A.

Tools and Machines for Sheet Metals, Presses and Punches, Power Shears, Tinsmiths' Tools, Forming Rolls, Dies, Etc.

Our line of tools and machines for working sheet metals is very extensive, the machines here illustrated comprising only a few representative types. We use nothing but the best of materials, and the castings are made in our own foundry. Superior facilities and a force of expert workmen enable us to produce work of the highest class.

Our products are presented on their merits and we solicit an examination of their efficiency and durability.

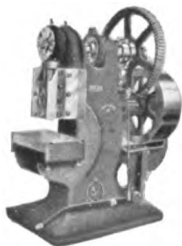


No. 6 Niagara Inclined Power Press

INCLINABLE PRESS

These presses are unsurpassed in workmanship, convenience and durability, and the range of work for which they are suited is almost unlimited, including blank cutting, punching, forming, and combination dies. The wearing surfaces are large and all parts well fitted.

9 sizes ranging from 500 to 7300 lbs. weight.



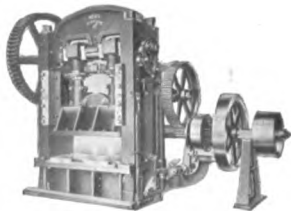
No. 38 Niagara Geared Power Punching Press

PUNCHING PRESS

These presses are adapted to heavy work, the design combining strength and compactness with convenience in handling the work. They are especially suitable for punching and cutting bars and heavy sheet metal; for operating cutting and forming dies required in the manufacture of hardware, cutlery, etc.

Five sizes geared.

Five sizes not geared.

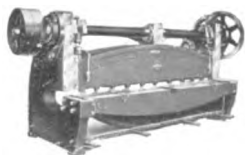


No. 615 Niagara Power Press Double Crank Type

DOUBLE CRANK PRESS

This press is intended for operating dies covering a large area and where great power is required. The speed is so regulated that in some cases the operators can remove and feed the sheets between two strokes without stopping the motion of the slide.

Will take work up to $13 \times 56\frac{1}{2}$ inch area.



Niagara Power Squaring Shear No. 9128

POWER SQUARING SHEARS

This illustration shows one of our largest shears capable of shearing $\frac{1}{4}$ -inch sheet steel, with a cutting length of 126 inches and a gap of 18 inches.

We make many smaller styles and sizes down to the No. 10 series intended for No. 22 iron and lighter.

Complete Catalog on Request.

WILLIAMS, WHITE & CO.

MOLINE, ILLINOIS, U. S. A.

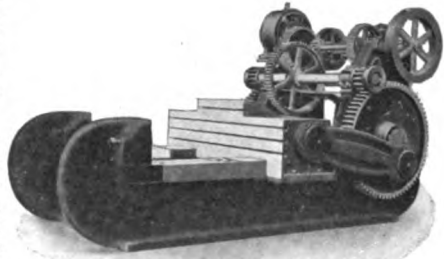
PITTSBURGH OFFICE
808 House Building

CHICAGO OFFICE
933 Monadnock Block

Forging, Punching and Shearing Machinery; Coaling Stations

BULLDOZERS: Nearly forty years of Bulldozer manufacturing. These machines are used for an incredible number of purposes. General purpose Press with practically unlimited possibilities. Built in ten sizes, and two types.

YEAKLEY VACUUM HAMMERS: Recent and important improvements place this hammer at the head of Forging Hammers, both in power and control. Speed of blow is maintained, forging both light and heavy. Built in sizes from 40 to 650 lbs. Adaptable to motor drive



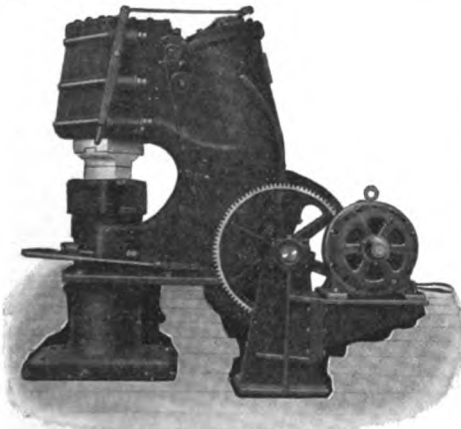
Bulldozer

JUSTICE SPRING HAMMER: Silico manganese steel springs furnished.

MOLINE HELVE HAMMER: Extra heavy in design.

BOARD DROP HAMMER: Very much improved. Exceptionally easy of operation and large output.

CRANK (OR ROPE LIFT) DROP HAMMERS: Stand very severe service with comparatively small upkeep. Particularly adapted to the carrying of large dies, for bending, shaping, forming and straightening. Made in three styles of Lifters—Sandage, Ratchet and Peck.



YEAKLEY Hammer

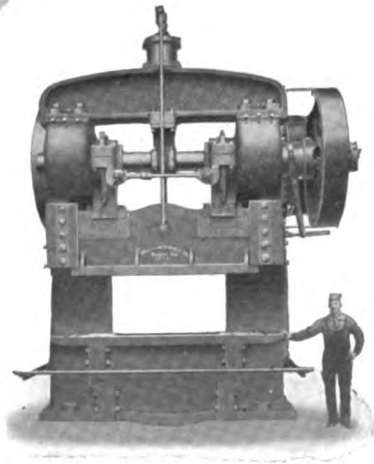
MULTIPLE PUNCHES: These machines are made in nine sizes with varying lengths and throats. Special adaptations for special work furnished. Machines range in weight from 5,000 to 250,000 lbs.

PUNCHING AND SHEARING MACHINES: "C" type, Double and Single End Machines. Open-fronted Bar Shears, and Guillotine Shears.

COPING AND STRUCTURAL PUNCHES AND SHEARS: Complete line of the above machines, covering a wide range of throats, capacities, types of jaw, equipment, etc.

Our line also includes: Upsetting, Forging and Rivet Machines, Eye Benders, Multiple Head Tapping Machines, Bending and Straightening Machines, Horizontal Punches, Hydraulic Presses, Power and Trimming Presses, Stay Bolt Breakers, Rotary Riveting Hammers, Angle Bending Rolls and Angle Shears.

COALING STATIONS FOR COALING LOCOMOTIVES.



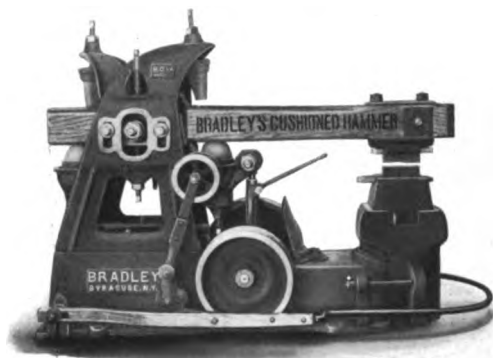
Multiple Punch

C. C. BRADLEY & SON, INC.

SYRACUSE, N. Y.

Manufacturers of Bradley Cushioned Power Hammers, Forges

THE BRADLEY Rubber Cushioned HELVE HAMMER



BRADLEY HAMMERS are made in Helve, Upright Strap, Upright Helve, and Compact styles, with heads ranging from 15 lbs. to 500 lbs., and capable of forging iron, steel and other metals from five inches square down.

216

If your work is continuous, like plating, drawing, swaging, collaring, welding or spindle work, with infrequent changes in size of material, or if it is die work where perfect accuracy and the finest finish are imperative, let the Bradley Helve Hammer be your choice. No other Hammer is like it. No other Hammer can equal it.

If your work is of a general, all-around jobbing character, with frequent variations in the size of stock, or is of such a nature that the Hammer is not worked continuously, but with frequent stops, a Bradley Upright Hammer may best answer the purpose.

If your work is such as described last above, and your floor space is limited, but with good height, and a somewhat less first cost is an object, we suggest the Bradley Compact Hammer.

DON'T GIVE THE FIRST COST of a Hammer too much prominence. The question of greater output, uninterrupted work, reduced cost for repairs and greater durability, are of more importance. Any excess in price of Bradley Hammers over others, is more than made up in the Hammers themselves.

More Bradley Hammers are sold each year than of all other power Hammers combined. Separate circulars of each.

WE MAKE

The Bradley Cushioned Helve Hammer The Bradley Upright Helve Hammer
The Bradley Upright Strap Hammer The Bradley Compact Hammer
Forges for Hard Coal or Coke

ATLAS PRESS CO.

310 No. PARK St., KALAMAZOO, MICH., U. S. A.

EFFICIENT ARBOR PRESS EQUIPMENT

ATLAS PRESSES are built in all sizes to meet every requirement for tools of this type. Pinions are cut from forgings of Chrome Vanadium—Rams from specially treated Chrome Nickel. All parts designed to give highest degree of efficiency under all service conditions. Complete details upon request.

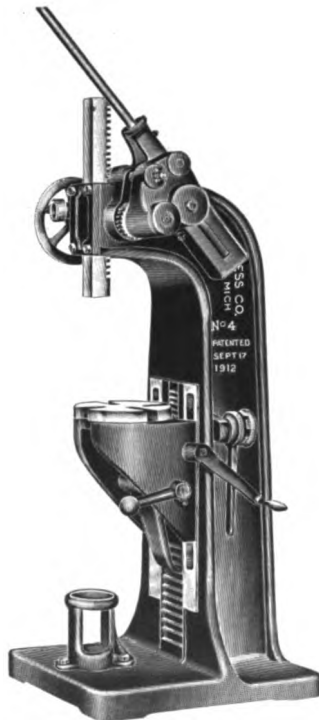
Carried in stock by leading machinery dealers everywhere.



No. 24 Press



No. 3 on Stand



No. 4 Press

THE ACME MACHINE TOOL CO.

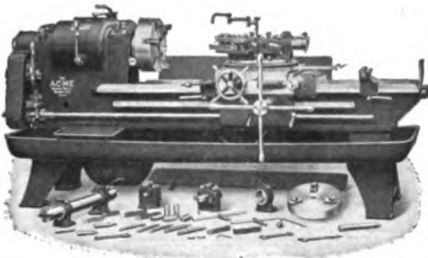
CINCINNATI, OHIO, U. S. A.

Code Word: ACME

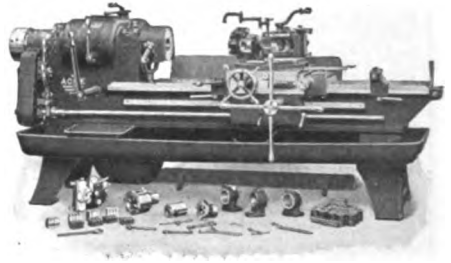
Lieber's Code

CINCINNATI ACME

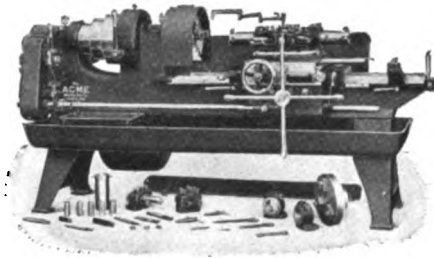
FLAT TURRET LATHES, SCREW MACHINES, TURRET LATHES, BRASS WORKING MACHINES, UNIVERSAL TURRET LATHES, AND ALL TOOL ACCESSORIES



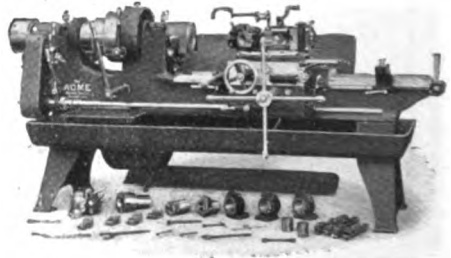
3 1/4"x36" Flat Turret Lathe with Chucking Equipment



3 1/4"x36" Flat Turret Lathe with Bar Equipment

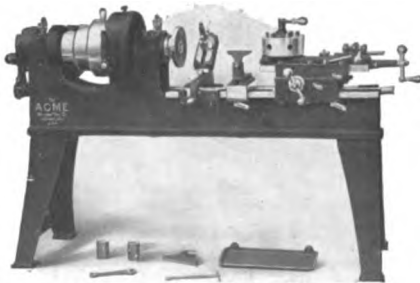


2 1/4"x26" Flat Turret Lathe with Chucking Equipment



2 1/4"x26" Flat Turret Lathe with Bar Equipment

FLAT TURRET LATHES, the double purpose machines. Adapted to both bar and chucking work. Using simple inexpensive tools. The greatest producers of work from bar stock, forgings and castings. Capacity bar stock 2 1/4" and 3 1/4" and chucking work 12" and 16" diameter.



18" Universal Turret Lathe



2 1/4"x11" Screw Machine

SCREW MACHINES made in five sizes. Automatic Chuck capacity 3/8" to 2 1/4", 11" to 20" swing. Plain or friction geared head with or without automatic feed to turret

TURRET LATHES AND BRASS WORKING MACHINES made in four sizes. 14" to 20" swing. Plain or friction geared head, with or without automatic chuck, bar feed, automatic feed to turret, or cut off rest. Furnished with plain, set over or universal turret, also chasing attachment, forming attachment and all tools for rapid and accurate production.

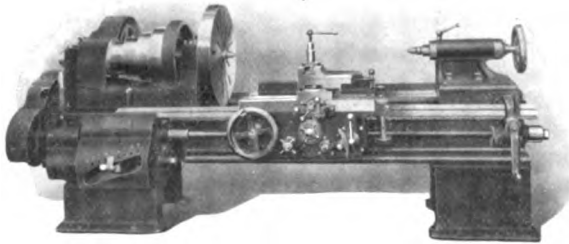
PITTSBURGH MACHINE TOOL CO.

BRADDOCK, PA.

Manufacturers of Heavy Engine Lathes and Curtis Rotary Pumps

PITTSBURGH ENGINE LATHES

Designed for heavy work Built in 26", 28", 32", 38" and 42" sizes. Specifications of 26" size, which are typical of the entire line of Pittsburgh Lathes, are given below.



26" Double Back Geared Engine Lathe

HEAD STOCK is designed for heavy work. Spindle is 60 carbon hammered steel with ample bearings. Spindle is ground. Bearings are 6 to 1 copper and tin and are carefully scraped to fit spindle. The cone pulley is of large diameter and made with either three or four steps. Head Stock is furnished with double back gearing and the back gear pinion is semi-steel. The feed driving gears are all coarse pitch, wide face and made of semi-steel.

TAIL STOCK is what is known as European design, and has long bearings on the ways. Spindle is of large diameter and the nut is bronze.

CARRIAGE is heavy and substantial and has bearing the whole length of the ways. It is gibbed to the bed its whole length and the bearings are not recessed.

CROSS SLIDE AND COMPOUND REST have large bearing surfaces, the Cross Slide sliding in a female way in the carriage, which affords the stiffest kind of construction. Compound Rest is of rigid design and all slides are scraped to a fit. The Cross Slide is furnished with taper bronze gib and the Compound Rest with steel gib to take up wear. Cross Slide is furnished with automatic cross feed.

APRON is of rigid construction and the driving gears are all steel except the first friction gears. The rack pinion has double bearing. Apron is provided with safety device for the prevention of throwing in two feeds at the same time.

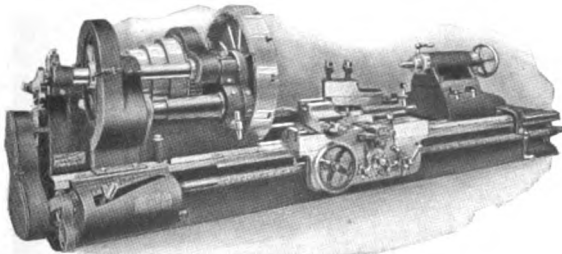
QUICK CHANGE OF FEED is very heavily constructed and is extremely simple. All the gears inside the feed box are semi-steel. The following threads can be cut with the gears furnished with the lathe: 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, $1\frac{1}{2}$, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2 , $2\frac{1}{4}$, $2\frac{1}{2}$, $2\frac{3}{4}$, 3 , $3\frac{1}{4}$, 4 , $4\frac{1}{2}$, 5 , $5\frac{1}{2}$, 6 , $6\frac{1}{2}$, 7 , 8 , 9 , 10 , 11 , $11\frac{1}{2}$, 12 , 13 , 14 and 16 threads per inch.

LEAD SCREW is two pitch and is made of high carbon steel. It is accurately cut and has a spline running the whole length in which the feather of the lateral feed gears rides, so that the threads are used for screw cutting only.

BED is heavy and rigid and is carefully planed and fitted and is provided with cabinet legs.

ACCURACY—Guaranteed to bore straight and face square within .001 of an inch in one foot.

GEARING—Double back geared and with four step cone for $3\frac{1}{4}$ " belt has 12 changes of speed; with 3 step cone for $4\frac{1}{4}$ " belt has 9 changes of speed. Cone is $15\frac{1}{4}$ " diameter in the largest lift.



42" Triple Geared Engine Lathe

JONES & LAMSON MACHINE CO.

SPRINGFIELD, VERMONT, U. S. A.

97 QUEEN VICTORIA STREET, LONDON.

Germany, Holland, Switzerland, Austria-Hungary: M. Koyemann, Charlottenstrasse 112, Dusseldorf. France, Spain and Belgium: F. Auberty & Co., 91 Rue de Maubeuge, Paris.

Manufacturers of Flat Turret and Automatic Lathes

HARTNESS FLAT TURRET LATHES



WITH BAR OUTFIT

Geared, quick change speeds and feeds, flat turret, stops that really stop, and a remarkable set of bar tools, capable of producing almost any piece of work within the dimensional capacity of the machine. Equipped with the Hartness Automatic Opening Die.

WORKING RANGE
for the $2\frac{1}{4} \times 24$ machine: Hole through spindle is $2\frac{1}{4}$ inches in diameter.

Greatest length turned is 24 inches. Swing over carriage is $12\frac{1}{2}$ inches. Cross travel of head is $8\frac{1}{2}$ inches. Equipped to handle round rough bars up to $2\frac{1}{4}$ inches in diameter; hexagon and octagon bars up to $1\frac{3}{4}$ inches; square bars up to $1\frac{1}{4}$ inches, and flat bars up to $1\frac{3}{4} \times 1\frac{1}{2}$ inches. With special jaws, flat stock up to capacity of spindle.

The 3×36 machine with bar outfit is the same thing on a larger scale; capacity as follows:

WORKING RANGE. Hole through spindle is $3\frac{1}{4}$ inches in diameter. Greatest length turned is 36 inches. Swing over carriage is $14\frac{1}{4}$ inches. Cross travel of head is $8\frac{1}{2}$ inches. Equipped to handle round rough bars from 1 to 3 inches in diameter; hexagon, octagon, square and flat bars from 1 to 2 inches. With special jaws, hexagon and octagon up to $2\frac{3}{4}$ inches and flat stock up to capacity of spindle.

WITH CHUCKING OUTFIT

THE CROSS-SLIDING HEAD. This is the only turret lathe in which the work-carrying headstock has a cross travel. This is indispensable on chuck work and is frequently convenient on bar work. It gives a cross feed for every tool without resorting to the frail double slide under the turret. Nine speeds in both directions from 13 to 284 revolutions per minute instantly obtainable. All gears run in oil bath.

THE TURRET. This is the original flat turret, 18 inches in diameter, and is gibbed at outer edge. Index pin is located directly under working tool.

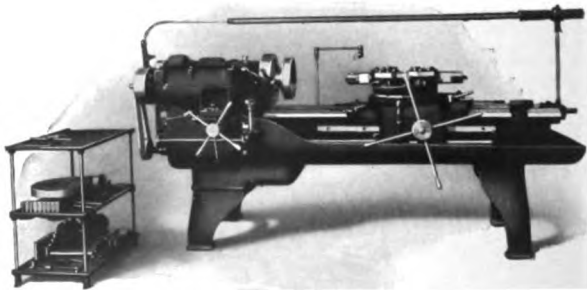
THE POWER FEED. Both the carriage and the cross-sliding headstock are provided with power feed. It operates in both directions; has nine changes, from 20 to 120 revolutions per inch of travel. These changes are instantly obtainable by sliding gears.

STOPS. Each position of turret is equipped with two separate stops, making twelve in all. If desired, seven stops can be used for one tool. The cross travel of the head is controlled by nine stops. Both sets of stops act in both directions, and are placed as near as possible to the direct line of stress.

The swing over the carriage on the $2\frac{1}{4} \times 24$ machine is $12\frac{1}{2}$ inches. Cross travel of head, $8\frac{1}{2}$ inches.

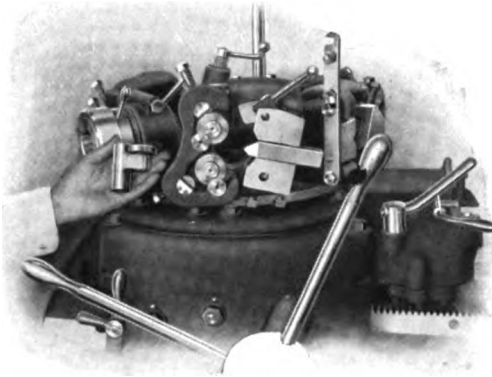
The 3×36 inch machine swings with chucking outfit $14\frac{1}{4}$ inches; same cross travel.

TOOL EQUIPMENT. Besides the scroll chuck and face plate for holding the work, the machine is equipped with an outfit of boring bars, drill holders and cutting tools, which makes it ready to handle ordinary work as soon as supplied with driving power.



JONES & LAMSON MACHINE CO.

SPECIAL FEATURES



THE ORIGINAL FLAT TURRET

The Flat Turret, shown herewith, was put on the market in 1891. Over ten thousand (10,000) machines equipped with them have been built and sold since, to the great satisfaction of the users. A large, steady tool clamping surface, a circular gib holding the turret down clear around its periphery, a locking pin directly under the cutting point of the tool—all

these features combined to set a new standard of output, accuracy and range of work in turret lathe practice.

The unique set of tools shown covered at one leap the evolution from the old-fashioned "screw machine" to the modern turret lathe. It enabled the turret lathe to practically displace the engine lathe on bar and stud work.

THE CROSS-SLIDING HEAD

This feature, introduced in 1903, still further extended the field of the turret lathe, making it the standard machine for most chuck work of moderate size. The Cross-Sliding Head has three advantages: (1) It offers a cross-sliding motion gibbed directly and securely to the bed. There is no piling of slide on slide, no narrow bearing foundation for a lofty



superstructure of slide, tool holder and tool. (2) It permits the cross feed to be applied to every tool on the turret if necessary. (3) By allowing a cross adjustment to every tool, complicated and costly special tools are minimized. The regular outfit covers all regular work. The design is so stable that the piloted type of holder is seldom needed.

(Continued on next pages)

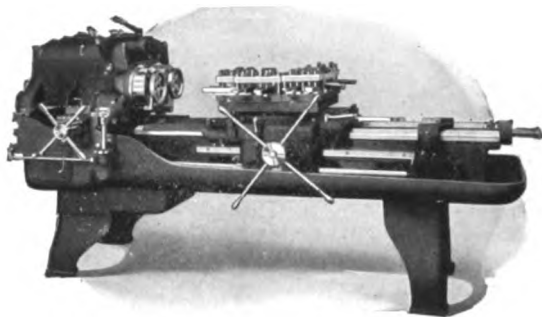


(Continued from preceding pages)

JONES & LAMSON MACHINE CO.

SPRINGFIELD, VERMONT, U. S. A.

HIGH PRODUCTION MACHINES



HARTNESS DOUBLE SPINDLE FLAT TURRET LATHE FOR CHUCKING WORK

Two spindles, two sets of tools, two pieces of work. One turret, one cycle of operations, one operator. Practically double the output at about the same expense.

Introduced four years ago, and now the leading machine in the automobile field, and in similar lines where chuck work comes in large lots.

WORKING RANGE. Swing over carriage is 17 inches. Swing when both spindles are used is 10 inches. Cross travel of head is $10\frac{1}{2}$ inches. Hole through spindle is $3\frac{1}{4}$ inches.

Or it may be used as a single spindle machine, with a large chuck on the rear spindle, when it swings 17 inches.

THE FAY AUTOMATIC LATHE

An automatic machine for work held on centers, or carried on arbors. Particularly adapted to second operation work.

RANGE OF WORK. It swings 14 inches over the shears and 10 inches over the carriage. It will turn up to 10 inches in length. The movements are entirely automatic, the machine stopping itself when the work is completed.

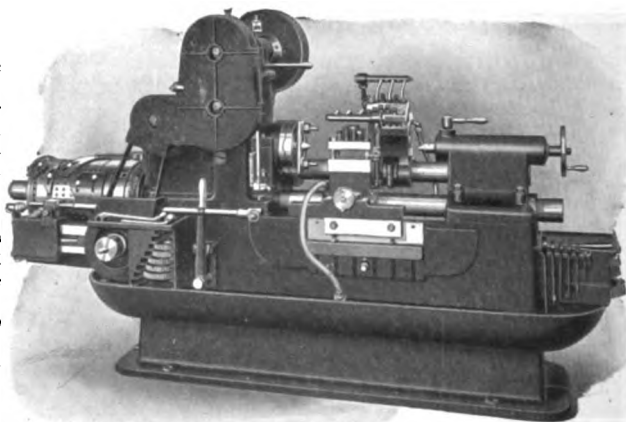
FEEDS. The movements of the various tools are controlled by adjustable cams. The cam-shaft has an adjustable quick drive for idle motions, and a slow drive through change gears for feeding.

CARRIAGE. The carriage, attached to the central shaft, has lateral motion obtained from cams on the drum. Movement in the vertical plane is given by removable formers, mounted on former slide and operated from the drum. These two movements may be made either separately or in conjunction.

BACK TOOL ARMS. The back tool holder is adjustable on the rear shaft and has a lateral motion controlled by the cam drum. Movement in the vertical plane is obtained from a separate heart cam. These movements may also be made separately or in conjunction.

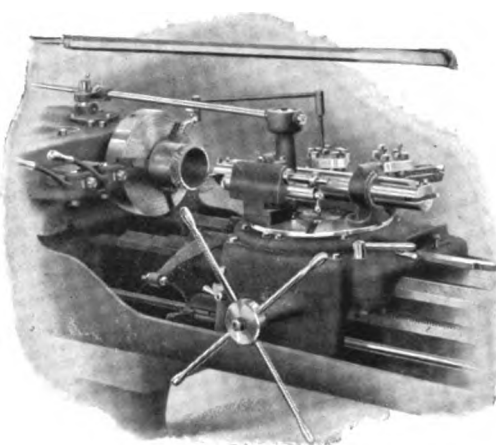
TAPER TURNING is effected by adjustment of the straight former on the former slide operating the carriage; for steep tapers, such as the faces of bevel gears, etc., a special bevel attachment is provided, controlling the back tool arm.

FORM TURNING in wide variety is also effected by formers operating the carriage. This is especially useful in crowning cone pulleys, etc.



JONES & LAMSON MACHINE CO.

UNIQUE EQUIPMENT FOR THREADING



AUTOMATIC CHASING ATTACHMENT

The Hartness Chasing Attachment is shown applied to the Flat Turret Lathe.

This attachment is automatic. The carriage is locked to the bed and the attachment clutched with its positive drive from the work spindle. The threading tool feeds forward at cutting depth under lead screw control until the tool bar strikes a stop. The tool is then withdrawn to clear the work and returned at high speed to the starting point, where it is again fed in to

cutting depth and engaged with the lead screw. The work spindle revolves continuously. The only motion required of the operator is that of adjusting the cross sliding head forward a slight amount during the return of the cutter to feed the tool in for the new cut. There is no possibility of overrunning and gouging into a shoulder, no matter how fast the machine is run.

The advantage of this attachment is that it gives engine lathe accuracy to turret lathe threading—and it gives much more than engine lathe speed.

HARTNESS AUTOMATIC DIE

Wide Range

Few Dies

High Accuracy

Small Expense

The No. 1 Die threads from $\frac{1}{32}$ inch to $\frac{1}{16}$ inch diameter, all pitches. The entire range from $\frac{1}{4}$ inch to $2\frac{3}{4}$ inches for standard threads, and to 3 inches for 8 pitch or finer, is covered by three sizes of dies whose ranges overlap.

Any of these dies, even the large No. 9, will thread pitches as fine as 32 per inch on its largest diameter without danger of stripping.

The lead-controlling feature is exclusive with this die. You can cut long threads as accurate in pitch as you will get from the ordinary engine lathe.



REED-PRENTICE COMPANY

WORCESTER, MASS.

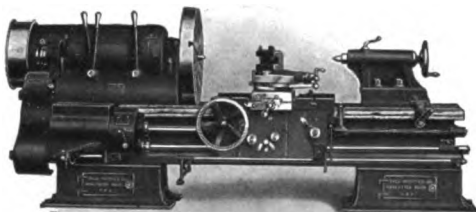
F. E. REED CO. DEPARTMENT
Established 1875

PRENTICE BROS. CO. DEPARTMENT
Established 1872

Builders of Lathes and Drilling Machines

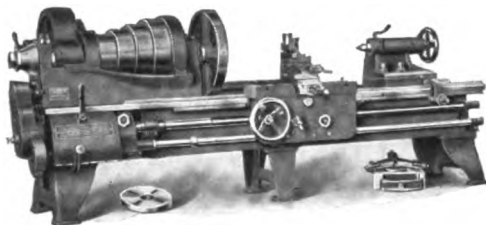
LATHES

Geared Head High Speed Lathes: The "Reed-Prentice" High Speed Geared Head Lathe has an all-friction clutch head stock making it the most rapid speed changing lathe built. Sizes 12", 14", 18", 20", 24" and 27". The "Reed-Prentice" High Speed Turret Lathe is a powerful and rigid machine designed for the rapid production of duplicate parts. Built in 16" and 18" sizes.



"Reed-Prentice" 27" High Speed Geared Head Lathe

Heavy Duty Double Back Geared: The "Reed-Prentice" Heavy Duty Lathe is designed and built to withstand the strain of constant heavy turning, and is especially adapted for Railroad and all kinds of Heavy Duty. Sizes 16", 18", 20", 22" and 24".



"Reed-Prentice" 24" Heavy Duty Lathe

Plain Turning—Double Back Geared: The "Reed-Prentice" Three-Step Cone, Double Back Geared Lathe is a rigid and powerful type of machine, designed to meet the demand for a modern engine lathe having sufficient power to use high speed steel cutting tools economically. Sizes 14", 16", 18", 20", 24" and 27".

Standard Single Back Geared:

The "Reed-Prentice" Engine Lathe is an accurate, reliable machine, embodying high grade workmanship throughout. Sizes 12", 14", 16" and 18". The 9" size is a screw-cutting lathe of exceptional value for small work.

The "Reed-Prentice" Standard Engine Lathe is especially adapted for a wide range of work, both light and heavy. Sizes 12", 14", 16", 18", 20", 22" and 24".

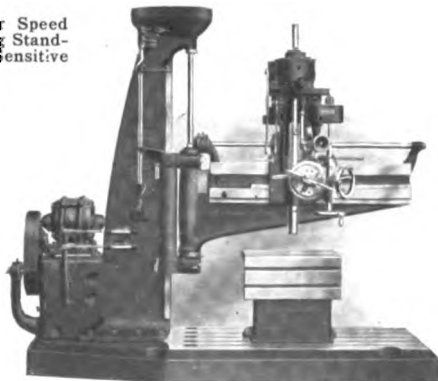
DRILLS

Radial, Plain and Ball Bearing—Gear Speed Change Vertical, Plain, and Ball Bearing Standard Pattern Vertical—Small Upright Sensitive Plain and Ball Bearing.

Ball Bearing Sensitive Drilling Machines: Built with one, two, three, four, five and six spindles. Amply "rigid" in construction to stand high spindle speeds without vibration.

Upright Drilling Machines: Built in 20", 21", 23", 24", 26", 28", 30", 36" sizes.

Ball Bearing Radial Drilling Machines: Centralized control of all levers reduces lost time to a minimum. Standard pattern made in 3', 4', 5', 6' Arm size. Heavy pattern made in 3', 4', 5' Arm size.



"Reed-Prentice" 4' Arm Heavy Pattern Radial Drilling Machine

THE WARNER & SWASEY COMPANY

CLEVELAND, OHIO

NEW YORK

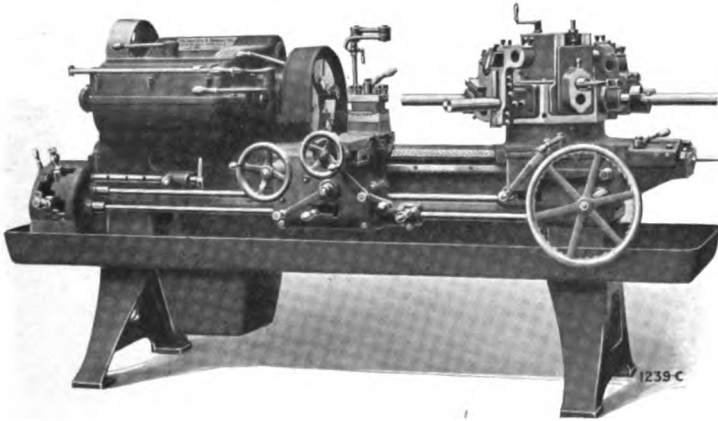
BOSTON

BUFFALO

DETROIT

CHICAGO

Manufacturers of Turret Machinery



No. 2A Universal Hollow-Hexagon Turret Lathe; Chucking Equipment

UNIVERSAL HOLLOW-HEXAGON TURRET LATHES

Capacities: No. 2A— $2\frac{1}{2}$ " x 29"— $16\frac{1}{2}$ " Swing
No. 3A— $3\frac{1}{2}$ " x 40"— $21\frac{1}{2}$ " Swing

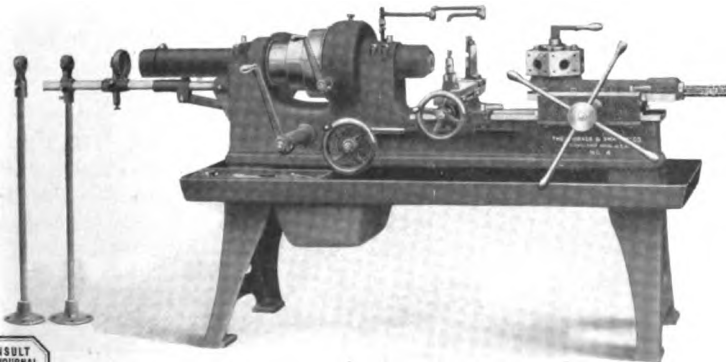
These machines can be arranged with capacities enlarged to
 $3\frac{1}{4}$ " x 29" on the No. 2A, and to
 $4\frac{1}{2}$ " x 40" on the No. 3A.

TURRET SCREW MACHINES

Five sizes, including the No. 4 Universal, which has independent power feeds for turret and carriage, permitting two cuts at one time.

PLAIN, SET-OVER AND UNIVERSAL TURRET LATHES

BRASS WORKING MACHINE TOOLS



No. 4 Turret Screw Machine



THE NATIONAL-ACME MFG. CO.

CLEVELAND, OHIO, U. S. A.

NEW YORK

BOSTON

CHICAGO

DETROIT

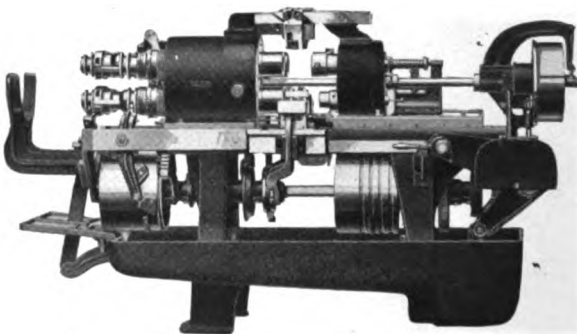
Screw Machinery, Dies and Screw Machine Products

ACME MULTIPLE SPINDLE AUTOMATIC SCREW MACHINES

Capacity

The Acme Automatic handles any screw-cutting work up to $2\frac{1}{4}$ " diameter and $10\frac{1}{2}$ " long in the time of one operation.

Furnished with either Single Belt or Motor Drive.



ACME AUTOMATIC MULTIPLE SPINDLE SCREW MACHINES are rapid producers of screws and parts from bars of Brass, Iron and Steel.

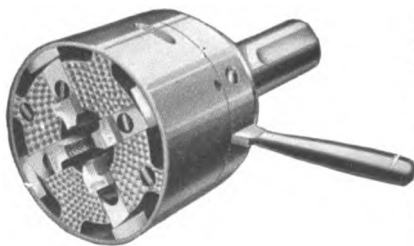
They carry four bars of stock upon which as many as eight tools can be worked at one time.

In addition to the usual tool equipment, tools for shaving, cross drilling, end and side milling, etc., can be employed without increasing the cutting time—one operation.

AUXILIARY SCREW-MAKING MACHINES of fully automatic and semi-automatic types are also built as follows: Stud Threaders, Bolt Threaders, Single and Multiple Spindle Drilling Machines for screw heads and special drilling operations, Screw Head Slotting Machines; also Die Chaser and Tool Grinder.

These machines are highly specialized for work that can be most economically done after the parts leave the screw machine. Catalog covering complete line on request.

NAMCO AUTOMATIC THREADING DIES



for every threading requirement include: Self-Opening Dies for Hand Machines; Self-Opening-Self-Closing Die Heads for Automatic Screw Machines, Bolt Threaders, etc. Adjustable Chaser Dies for heavy duty work; Adjustable Spring Dies and Collet Holders. Catalog?

THE NATIONAL-ACME MFG. CO.

(Successors to Windsor Machine Co.)

WINDSOR, VERMONT

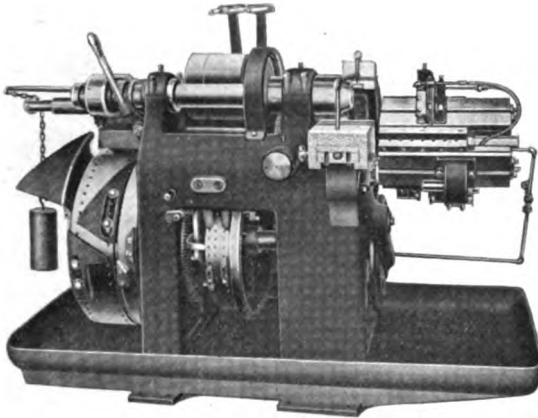
NEW YORK

BOSTON

CHICAGO

DETROIT

GRIDLEY MULTIPLE AND SINGLE SPINDLE AUTOMATIC SCREW MACHINES



The Single Spindle Gridley

is built in four sizes
—2¼"—3¼"—4¼"—
5", and handles work
up to 12" in length.

GRIDLEY SINGLE AND MULTIPLE SPINDLE SCREW MACHINES
are designed for making parts from bar stock up to 5" diameter.

They are fully automatic and the tools are held rigidly, close up to their cutting point.

The simplicity of the set-up allows for an exceptionally wide range of tooling.

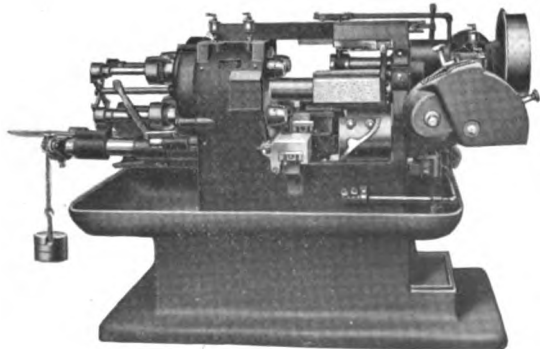
Many combinations of tools can be made on each slide, thereby doubling or trebling the work at one movement of the turret.

The tool slide on the Multiple Machine is mounted upon an extension of the spindle carrier which insures correct alignment of tools with spindles at all times.

Both Single and Multiple Spindle Gridley Automatics are furnished in Belt or Motor Drive. 94 page catalog free.

The Four Spindle Gridley

is built in four sizes—
¾"—1¼"—1¾"—2¼",
and handles work up to
7" in length.

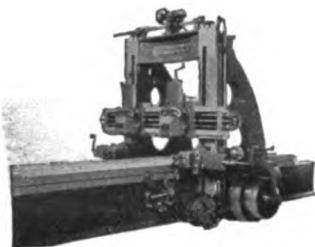


THE CINCINNATI PLANER CO.

OAKLEY, CINCINNATI, OHIO

Manufacturers of Planers and Boring Mills

CINCINNATI PLANERS are designed for strength, rigidity, durability, convenience in operation and adaptability for all classes of work required of a planer.



Standard Planer



Reversible Motor Driven Planer

Standard Planers are made in all sizes from 22" to 96". The beds are of a heavy deep box section and are especially strengthened where the gearing and uprights are mounted. The tables are of unusual thickness and are braced at short intervals with heavy ribs, thus preventing any possibility of springing under any circumstances. Cross rails are of great depth, and have an extra deep box brace on the back. The heads are distinctive, the ends of tool blocks and slides being made round. The gearing and rack are of extra wide face—all the large gears and racks being made from semi-steel castings and the pinions from steel forgings.

228

Widened Planers: There is a great variety of planing which does not require a standard machine and in many cases a widened planer will do the work better, as it is easier to handle and capable of higher speeds. We build these planers to suit your work, and have patterns for the various sizes given.

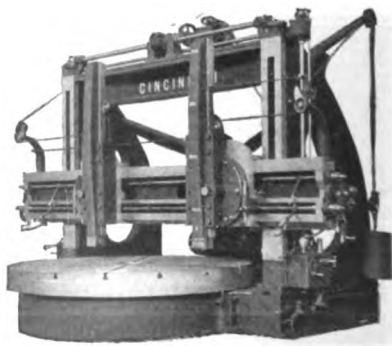
SIZES—34" x 24", 36" x 30", 42" x 36", 48" x 36", 56" x 42", 60" x 48", 72" x 56", 96" x 72".

Variable Speed Planers: The greatest possible gain in planing comes from access to a change of cutting speeds. A correct speed for all materials and conditions, instantly available, is the secret of economy in planing. Our variable speed planers are arranged for ten cutting speeds and ten return speeds.

Motor Driven Planers: All Cincinnati Planers may be arranged for motor drive.

CINCINNATI BORING MILLS are made in sizes of 6', 7', 8', 10', 12', 14' and 16'.

General Description: The bed is of deep box form throughout. All parts are thoroughly ribbed and braced and the entire mechanism of the mill is supported on the bed. The table is large in diameter and supported on a broad, flat annular bearing of a large diameter. The main driving gear is an internal gear cut from the solid. The housings are of massive box form, a wide and long base insuring rigidity under the most severe duty. The cross rail is of box form and has a deep arch on the back so that any deflection due to weight of heads or pressure of the cut is reduced to a minimum. The heads have the narrow guide bearing at bottom of rail, which prevents all tilting or binding while heads are under cutting strain. Eight different feeds are provided ranging from 1-32" to 1".



Standard Boring Mill

T. C. DILL MACHINE COMPANY, INC.

PHILADELPHIA, PA., U. S. A.

Builders of Slotters

THE "DILL SLOTTER"

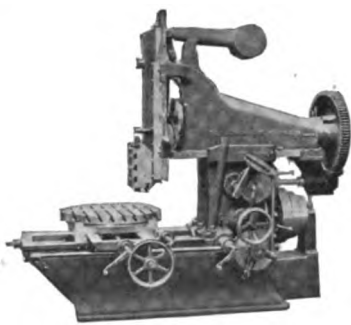
In the design of the "Dill Slotter," to meet the demands of today, it was plain that a departure was necessary and that procedure must be in at least two directions. First: that the machine must be able to produce a greater amount of work and that work must be more accurate. Second: that it must have a much greater range and not be confined only to the ordinary slotter work, but also reach out into other fields of usefulness; and, besides all this, it must be, if possible, more durable. The following features, which for the most part are exclusive, show how this Slotter meets the above requirements.

The GENERAL CONSTRUCTION of the "Dill Slotter" throughout is such as to insure efficiency and durability. It is constructed of the best material for the purpose; the gears are all cut from solid metal and mostly of forged steel; flat bearing surfaces are all hand-scraped to surface plates and are of ample dimensions. Gears, shafts, etc., are readily accessible for inspection. The convenience of operation is of special merit; while it is operative from one point principally, hand feeds are provided on all sides.

Attributes

- A Traveling Head**—Greatly increases the range of the machine.
- A Quick Traverse Gear**—A great time and labor saver.
- New Quick Return**—Permits high and uniform cutting speeds.
- New Intermittent Feed**—For feeding heavy work at high speeds.
- An Automatic Knock-Off**—A safety device for the feed mechanism.
- A Stroke Indicator**—Quite indispensable; nothing like it.
- A Hand Wheel Controller**—A good thing, and in the right place.
- A Tool Post in the Relief Apron**—Very handy in changing tools.
- Six Changes of Speed**—About four is the usual number.
- Belt and Motor Driven**—Designed for both; not a make-shift.
- Powerfully Geared**—About double the usual ratio.

15 Inch Slotter. Belt or Motor Driven



Arranged for Belt Drive

PRINCIPAL DIMENSIONS

Size of machine, in.....	10	10-12	15	15-18	20	20-24
Maximum stroke, in.....	10½	12½	15½	18½	21	25
Longitudinal movement of table, in.....	28	28	36	36	48	48
Transverse movement of table, in.....	20	20	30	30	40	40
Diameter of table, in.....	24	24	34	34	44	44
Movement of head, in.....	15	15	20	20	30	30
From table to head, in.....	12	12	19¼	19¼	24½	24½
Adjustment of ram, in.....	16	16	23	23	32	32
Will cut to the center of circle of.....	54 in.	54 in.	72 in.	72 in.	92 in.	92 in.
Will cut to outside of circle of.....	54 in.	54 in.	90 in.	90 in.	108 in.	108 in.
Strokes of ram per minute, r. p. m.....	11½-85	10-76	8-48	7-43	6-31	5½ to 27
Feed of table per stroke, in.....	0.011	0.011	0.010	0.010	0.0069	0.0069
Circular feed per stroke at 12 in. dia. (in.)..	to 0.154	to 0.154	to 0.187	to 0.187	to 0.138	to 0.138
Feed of head per stroke, in.....	0.0187	0.0187	0.011	0.011	0.0055	0.0055
Ratio of gears from cone pulley shaft.....	to 0.261	to 0.261	to 0.196	to 0.196	to 0.11	to 0.11
Size of countershaft pulleys, in.....	0.0055	0.0055	0.005	0.005	0.00345	0.00345
Speed of countershaft, r. p. m.....	to 0.077	to 0.077	to 0.093	to 0.093	to 0.069	to 0.069
Horsepower of motor.....	12 to 1	12 to 1	18 to 1	18 to 1	24 to 1	24 to 1
Speed of constant speed motor, r. p. m.....	14 x 3½	14 x 3½	20 x 4	20 x 4	26 x 5	26 x 5
Speed of variable speed motor, r. p. m.....	200	180	200	180	200	180
Net weight, lbs.....	3	3	5	5	10	10
	1,200	1,000	1,200	1,000	1,200	1,000
	400 to	400 to	400 to	400 to	400 to	400 to
	1,200	1,200	1,200	1,200	1,200	1,200
	5,000	5,250	10,000	10,500	23,000	24,000

THE FELLOWS GEAR SHAPER CO.

SPRINGFIELD, VERMONT, U. S. A.

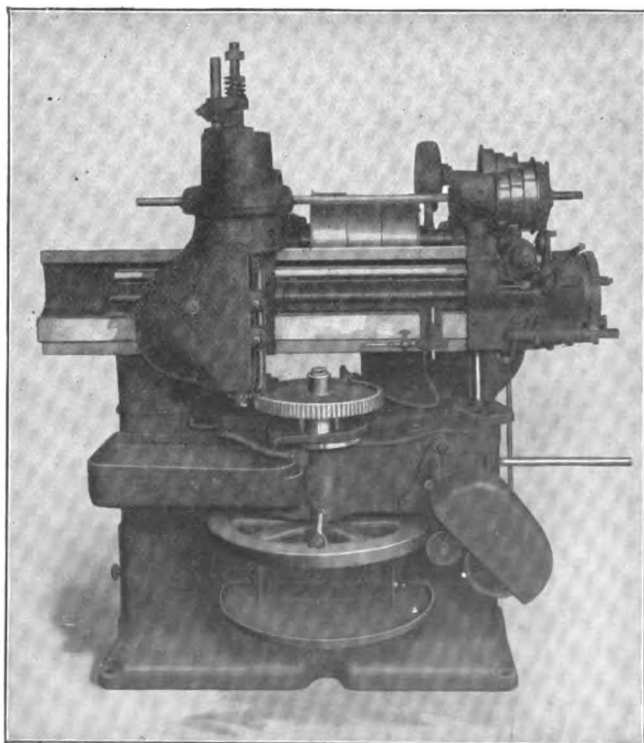
Manufacturers of Gear Shapers and Gear Shaper Cutters

THE FELLOWS GEAR SHAPER

In the Gear Shaper System a generating cutter is used, only one being required for any number of teeth of a given pitch. This cutter is first hardened and then all distortion and inaccuracies are ground away, the teeth, when finished, having been brought to the correct involute.

The No. 6 Gear Shaper cuts external spur gears of 35 inches diameter, 5 inches face, 4 diametral pitch, and internal spur gears of 26 inches pitch diameter, 3 inches face, 4 diametral pitch.

The No. 65 Helical Gear Shaper cuts helical gears up to 35 inches diameter, 5 inches face, 6 pitch.



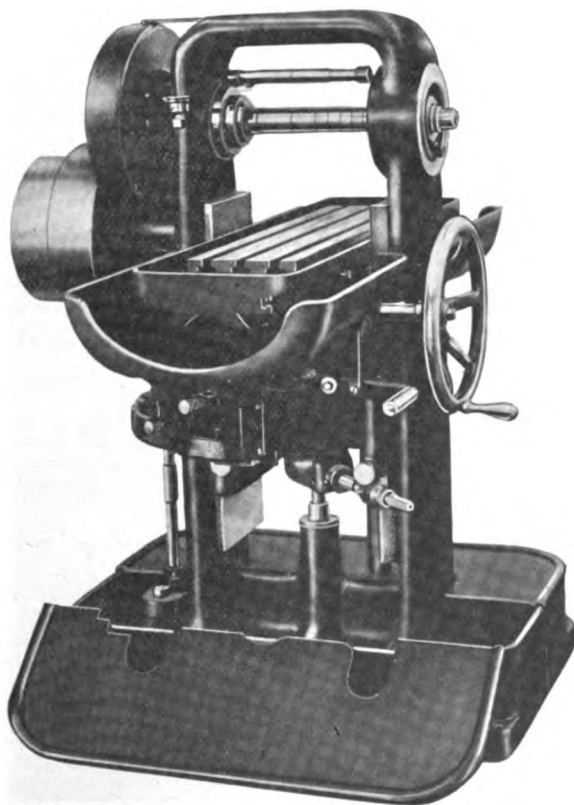
No. 6 Gear Shaper

GOOLEY & EDLUND, INC.

CORTLAND, N. Y., U. S. A.

Manufacturers of High Duty Milling Machines

BRIGGS MILLING MACHINES



FEATURES:

—
**CONVENIENCE
OF OPERATION**

—
**HIGH
PRODUCTION**

—
RIGIDITY

—
POWER

—
SIMPLICITY

—
ALIGNMENT

—
**AMPLE MEANS
FOR
LUBRICATION**

—
WORKMANSHIP

—
DURABILITY

231

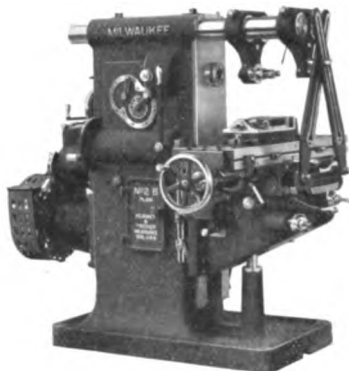
A manufacturing machine particularly adapted to the making of automobile, gun and similar parts where close limits and smooth cutting is required in the rapid production of duplicate parts.

A radical departure has been made from conventional milling machine design to secure greater rigidity and power than is possessed by any other machine of corresponding size and weight. The solid arched frame with the heavy bed strongly gibbed to both sides gives a rigidity of relation of arbor to table which is not disturbed by the stress and vibration of heavy cuts of high speed or hard steels.

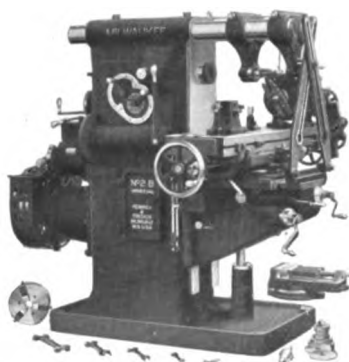
The powerful rigid feed, quick table return, ease and speed of handling, and simple and rigid construction are a few of the good features which we would like to tell you more about.

KEARNEY & TRECKER CO.

MILWAUKEE, WIS., U. S. A.



NO. 2B PLAIN



NO. 2B UNIVERSAL



NO. 2 1/2 B VERTICAL

MILWAUKEE MILLING MACHINES

The Double Over Arm Miller

With Constant Speed Drive
and Flooded Lubrication

The Double Over Arm is clearly shown by the half-tone engravings and consists of two steel bars arranged accurately parallel with the spindle at sufficient distance apart to form a rigid truss when the arbor supports are clamped to them.

The Work Table is made of semi-steel and finished all over as experience has shown that where scale is left on one side the table does not long retain its accuracy.

The Box Section Knee has no slot through the top to close under pressure of the saddle clamp or strain of the cut.

The Flanged Spindle provides means for holding the cutters for driving in either direction. The clutch collar keyed to the face of the spindle provides an ideal drive for the arbors.

The Spindle Reverse is contained within the machine so that right- or left-hand cutters can be used without reversing the driving belt.

The Drive is through a single pulley running at a constant speed, giving 18 spindle speeds in geometrical progression of about 20 per cent.

The Lubricating System consists of a reservoir in the base of the machine holding several gallons of machine oil that is pumped to the top of the machine and distributed by a perforated pipe to all gears and bearings, cascading downward over all of these on its way back to the reservoir. All oil grooves are cut through so that the oil will wash away any foreign material and keep the bearings in perfect condition.

A Cutter Lubricant Pump is provided on every machine as all machines are usually used on steel or other material requiring lubricant. Adequate provision has been made for the return of the lubricant to the reservoir.

Catalogue describing our complete production in detail, mailed on request.

SLOAN & CHACE MFG. CO., LTD.

OFFICE AND WORKS

SIXTH AVE., COR. N. 13TH ST., NEWARK, N. J.

Manufacturers of Precision Machinery, Dies and Special Tools

PRODUCTS: Bench Lathes, Bench Milling Machines, Special Machinery, Jigs, Fixtures, Punches and Dies for Sheet Metal, Gauges, Countershafts, Etc.



No. 5½ Bench Lathe

NO. 5½" BENCH LATHE

With Compound Slide Rest

CAPACITY: 7" swing, 18" between centers (bed 35 inches long), ⅝" through draw-in spindle, ¾" with draw-in spindle removed.

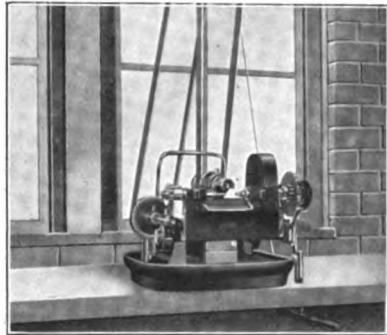
AUTOMATIC PINION CUTTERS

CAPACITY: No. 1, ¾" diameter, 1" face; No. 2, 1⅝" diameter, 1½" face.

Automatic Pinion Cutters are built in two sizes, designated as Nos. 1 and 2. The No. 1 machine (illustrated) has a capacity up to ¾" diameter and 1" face. The No. 2 machine is similar in construction to the No. 1, but larger, and having a capacity for gears and pinions up to 1⅝" diameter and 1½" face.

These machines are designed for the rapid production of cut pinions and small spur gears for watches, clocks, typewriters, etc., and both the No. 1 and No. 2 machines are built in three styles—to carry one, two or three cutters.

SPEEDS: Cutter spindle, 1600; worm shaft, 1200; countershaft, 750; cutter feed, 0.07 per revolution.



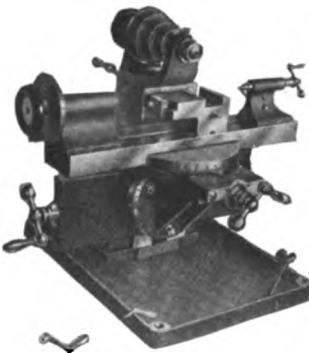
No. 1 Automatic Pinion Cutter

BENCH MILLING MACHINES

Bench Milling Machine is designed for use in the tool room, or for experimental work, though it is adapted to some classes of manufacturing. It is mounted upon the bench, or a cast iron pedestal 36" high.

COUNTERSHAFTS

Suitable Countershafts are provided for all of our many different machines. Lathes are required to perform such a great variety of work and under such varying conditions that we have found it necessary to provide several kinds of countershafts for them. They are Wall Countershafts, both two and three speeds; Wall-Rod Countershafts, one ("single") and two speeds; Grinding Countershafts, used with either Wall, or Wall-Rod Countershaft.



Bench Milling Machine

We build Special Machinery to individual order, assisting in its development and perfection. Fine Model Making and Gauge Work.

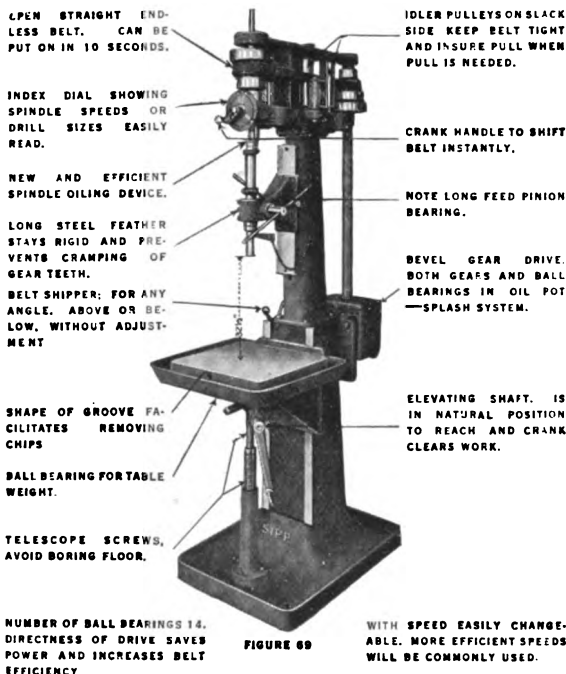
THE SIPP MACHINE CO.

PATERSON, N. J., U. S. A.

Manufacturers of the Sipp Quick Change Speed Sensitive Drill Presses

A RADICALLY DIFFERENT DRILL PRESS

High Grade High Speed All Ball Bearing



SAFETY FIRST DESIGN, pleasing and well balanced and effective, has four speed changes, *instantly* obtained without stopping the machine for each size drill, hence *efficient* speeds will be used, and when equipped with an automatic chuck, drills and tools may also be changed without stopping the machine. The **STRAIGHT BELT** transmits full power to the spindle and belt troubles are nil. **BELT STRETCH** is *automatically* taken up, the **OPERATOR** is not required to leave his working position, *minimum* oiling troubles, spindle sleeve is guided rigidly.

SIPP QUICK CHANGE SPEED SENSITIVE DRILL PRESSES are built in various combinations, from one to eight spindles, inclusive. They run *noiselessly*, and have *no clutches* and *no clashing gears*. The following types may be had: belt driven; Horizontal Motor, gear connected; Horizontal Motor, belt connected; Vertical Motor, single spindle, for high speed tools and drills, only oil or compound pumping outfit, for all type machines, pump located in bottom of tank, 8" overhang, 12" overhang. Tables 16" and 24" wide, respectively. Power and speed variations are sufficient to handle drills from the smallest to 29-32" diameter.

Full information and specifications on request.



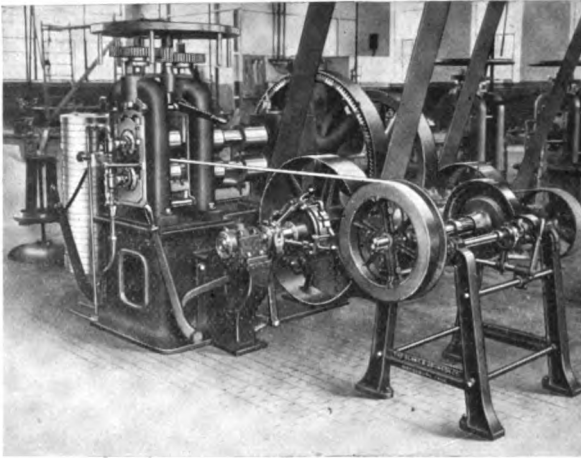
THE BLAKE & JOHNSON COMPANY

MACHINERY DIVISION

WATERBURY, CONN.

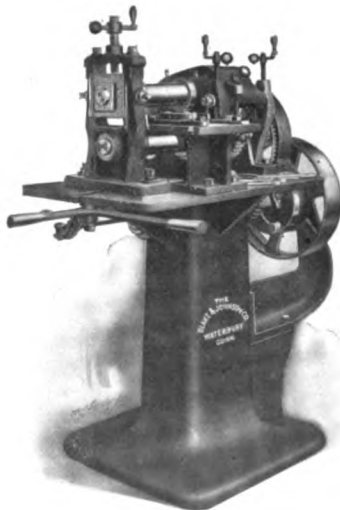
COLD ROLLING MACHINERY

For Steel, Brass, Copper, Etc.



235

**BUILDERS
OF
SLITTERS**



**SPECIALISTS
IN
MACHINERY
FOR
MANUFACTURING
METALS
IN
THIN GAUGES**

C. H. COWDREY MACHINE WORKS

FITCHBURG, MASS.

Contractors, Builders and Designers of Special Machinery

Established in Fitchburg, Mass., since 1875, we have kept pace with the progress of the city and with the demands of the whole machine world which is our market. Our reputation, financial, mechanical and progressive, is attested by competent authority.

A Modern Shop at Your Disposal

We use electric power and are equipped with the most efficient machinery. The shop has 40,000 feet of floor space, while the drafting room covers an area of 2,000 feet. These facts point out our constant state of preparation to competently handle all contracts.

Our large force of men, ably seconding our efforts, are the best machinists obtainable, for we long ago learned that the best man is the cheapest. Our Draftsmen and Engineers have both initiative and training.

We are a mechanical clearing-house, receiving your plans and issuing completed machines to order. If you have a new idea you wish to put into form, our whole plant is at your disposal—and remember all such work is held as strictly confidential.

Our organization has devoted *more than forty years' specialization* to the manufacture of special machinery. This experience covers special machines for knitting mills, paper making, woodworking and nearly every other kind of purpose and is sure to be of service to you.

A Few of Machines We Have Made

AUTOMATIC TURNING LATHES	BREAD WRAPPING MACHINES
HOSIERY KNITTING MACHINES	PAPER BAG FILLING MACHINES
BOBBIN TURNING AND BORING MACHINES	AUTOMATIC FEEDERS FOR PRINTING PRESSES
CELLULOID TURNING MACHINES	BUTTON HOLE MACHINES
POINTING MACHINES	LABORATORY MACHINES
SHOE MACHINES	HORN-PRESSES
OPTICAL MACHINES	ROCK DRILLS
SAFETY RAZOR MACHINES	GRINDING MACHINES
TAP AND DIE MACHINES	GUN BARREL MACHINES
PAPER TUBE MACHINES	JIGS, FIXTURES AND TOOLS

We have been trained by experience to constantly meet new demands. If you will send us a blue print we will promptly quote on same. If you prefer, we shall be very glad to have one of our Mechanical Engineers call on you.



THE H. E. HARRIS ENGINEERING CO.

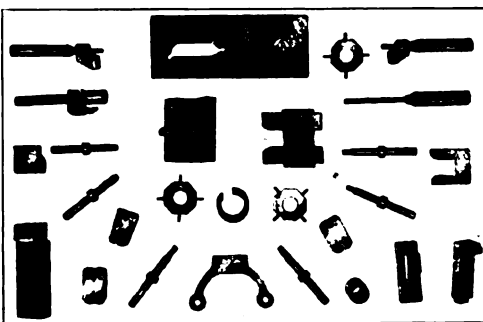
1041-1055 BROAD ST., BRIDGEPORT, CONN.

Engineers, Designers and Makers of Special Machines, Models and Cost-Reducing Devices, Gauges, Jigs, Fixtures, Dies, Tools and Accurate Interchangeable Parts. Special Taps and Dies. "Precision" Tapping Machines

The H. E. Harris Engineering Company are practical manufacturing engineers with twenty years of actual cost-cutting and quality-raising experience in quantity production.

We have our own plant and will build, as well as design, your special machinery, tools, jigs and fixtures, gauges, etc., or will manufacture your machines or parts on contract.

Our watchword is "work of the highest quality." We pay highest prices for raw material. Also labor, insuring expert service. Our **Master and Working Gauges** cost more than cheap inaccurate ones, but their quality counts as evidenced by their purchase by some of the largest manufacturing concerns in the country and their dependence upon our standards in their factories.



Group of Gauges Made in Our Gauge Shop

Special Machines: The illustration on the left below shows a special machine recently developed by us for notching Rear Sight Leaf of Russian Military Rifle. Owing to the delicate nature of the work and the peculiarities of its design, and as the clearance in which the tools have to work is very small, the

machine had to be carefully designed with view of eliminating backlash in the reciprocating parts. Provision also had to be made for taking up any lost motion due to wear.

Harris Precision Tapping Machines (Patented): A machine which will always work with the utmost precision to the exact depth required. Carried in stock. Illustrated at right.



THE BRIDGEPORT TOOL SHOP

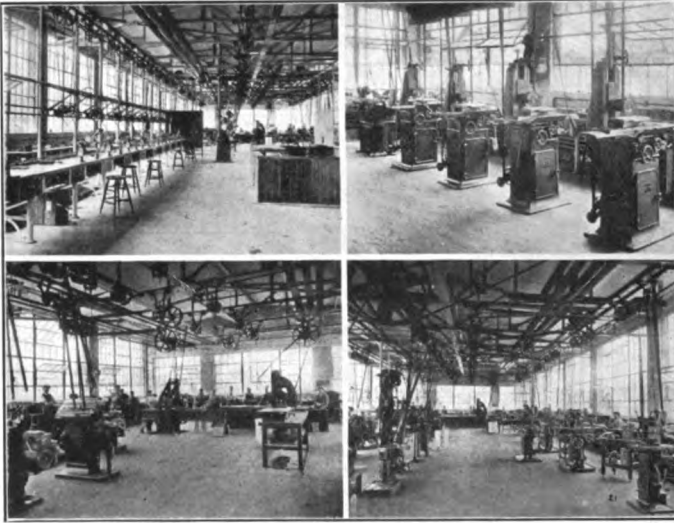
Our engineers will be glad to assist you in solving your problems.

MEHL MACHINE, TOOL & DIE CO.

OFFICE AND WORKS

ROSELLE, NEW JERSEY

Designers and Builders of Semi and Automatic Machines, Special Machinery, Tools and Dies, Sub-Press Dies



Interior Views of New Mehl Plant

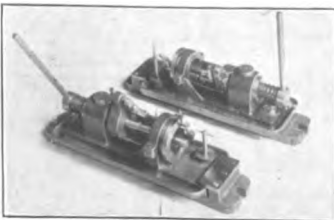
TRADE MARK **MEHL** **MADE** **JIGS, DIES, FIXTURES, GAGES, SPECIAL MACHINERY, WOOD AND METAL PATTERNS** now have a new home—a home worthy of the products themselves.

We are pardonably proud of this new home, of its modern construction, of the equipment and conveniences it contains.

We feel its accessibility to New York City is an advantage that will make for appreciable time saving.

We have chosen our workmen with the greatest care—each is an expert in his line.

These advantages combined with long experience in the making of better tools, are reasons why you will be serving your best interests by sending us your next order. We are sure you will be perfectly satisfied with both the price and quality of our work.



Accurate Milling Fixtures

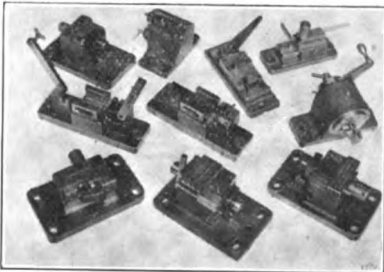
MEHL MACHINE, TOOL & DIE CO.

TRADE MARK
MEHL
MADE

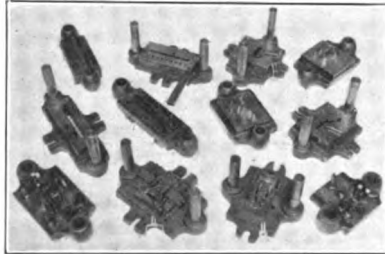
The purpose back of our organization is to assist you in *your* manufacturing, through the making of accurate jigs, gages, fixtures and tools.

This shop contains a complete equipment of the best high-grade precision tools, manned by a corps of experts. Our engineers are ready to design your special work, whatever its nature.

Our past experience covers a broad field, including all requirements as illustrated in the various groups below.



Milling and Indexing Fixtures



Complicated Dies



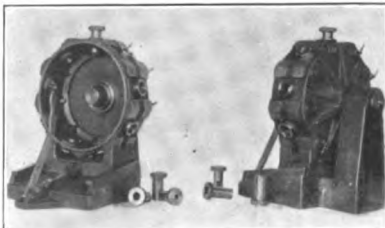
Drill Jigs and Fixtures



Variety of Gages



Variety of Small and Large Jigs



Large Indexing Drill Jig

THE TORRINGTON MFG. CO.

Incorporated 1885

TORRINGTON, CONN., U. S. A.

**Rolling Mill Machinery, Tube Drawing Machinery, Wire Drawing Apparatus,
Cabling and Stranding Machinery, Special Machinery, Contract Work, Etc.**

ROLLING MILL MACHINERY

For brass, copper, aluminum, sterling and German silver, zinc, bronze, steel — or other cold rolling and finishing.

For sheets, strips or plates; also rods. Flatteners, straighteners, coilers, slitters, shears, drying machines, scouring machines, saws, mills, stretching machines, rolls, overhauling machines, mill trucks, blockers, etc.

TUBE DRAWING MACHINERY

For tubes and pipes of brass and copper or other ductile metals. Draw benches, straighteners, cutting-off saws, testing benches, pointers, die grinders, etc.

WIRE DRAWING MACHINERY

For wire and rods. Bull blocks, draw benches, air hoists, threshing barrels, die stringing machines, continuous wire machines, fine wire machines, flat wire mills, trolley wire machines, rolls, straighteners, spooling machines, magnet wire machines, pointers, etc.

CABLING AND STRANDING MACHINERY

For twisting or stranding individual wires into finished cables, electrical conductors and wire rope. Twisters, twinners, stranders, capstans, spoolers, take-ups, take-offs, etc. Machinery for cables ranging from 2 to 91 wires.

SPECIAL MACHINERY FACILITIES

For satisfactorily producing special machines, from design to assembly. Drafting room, pattern shop, machine shop, forge shop. Screw machine, turret lathe and grinding departments. Buildings of modern construction. Exceptional attention to accuracy and privacy. Workmanship and material guaranteed.

CONTRACT AND JOBBING WORK

Of every description.

NOBLE & WESTBROOK MFG. CO.

HARTFORD, CONN., U. S. A.

Manufacturers of Dwight Slate Marking Machines, Marking Devices of Every Description, Expert Die Cutting and Engraving



No. 11 Power Marker

DWIGHT SLATE MARKING MACHINE

These Machines Will Mark Artistically Any Article or Any Material Suitable for Impressions

A specialty of our line of manufacture is the making of devices and machines for placing on flat or round metal surfaces, impressions of trade-marks, patent dates, graduated scales and a variety of similar work. These machines are not expensive, are adapted to the work, do it in a superior manner at less cost than is possible on any makeshift devices.

A neat mark is desirable, adds to appearance of goods, and is a feature that the manufacturer cannot afford to ignore. Goods of all kinds are put on the market in more tasty and improved form than a few years since. Both trade and purchasers call for these qualities. Antiquated and clumsy designs that were "good enough" are rapidly being displaced by improved forms and finish. By using modern machinery this is done at saving of original cost; therefore, when we offer better work at less cost we ask its consideration. Samples or sketches of work are solicited, proper machines recommended, and complete outfits furnished.

DIE CUTTING BY EXPERT ENGRAVERS

For These Machines a Specialty

We have a large force of expert engravers familiar with the die cutting for these machines and in order to get the best results, we would recommend that you send us samples and let us furnish you the first equipment of dies and fixtures.

Special Marking Machines Made to Order

We are in a position to furnish special Marking Machines for various kinds of work such as extra heavy marking where it is required to mark from ten to twelve lines of $\frac{1}{8}$ -inch lettering; also where extra large articles are to be marked.

Or for Numbering and Graduating

Fuse Caps, Micrometer Collars on Lathes,

Milling Machines, Etc.,

also Special Machine for

Marking Chucks

Take your troubles up with us and we will solve them for you.

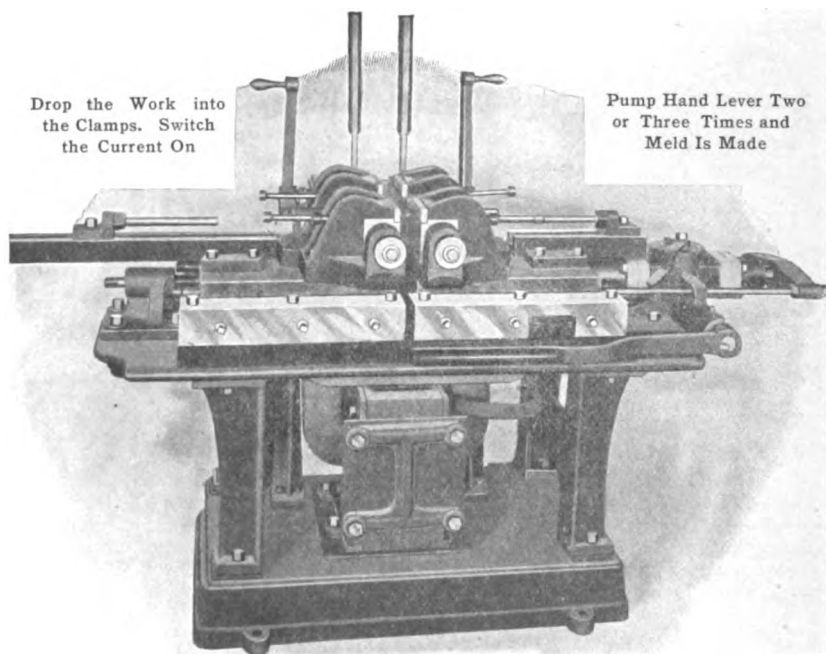


No. 3 Hand Marker

THOMSON ELECTRIC WELDING CO.

LYNN, MASS.

Manufacturers of All Kinds of Machinery for Electric Welding



A SERIOUS WASTE

Goes on in your shop. \$2 to \$3 is thrown into scrap heap every time you discard a piece of tool steel too short to use. With the above machine you can butt-weld these pieces to a piece of ordinary steel and use them to the last eighth of an inch. Economy on first 600 pieces will pay for the welder.

Consult the Pioneer Manufacturer
on your welding problems and get the benefit of 28 years of costly experience.

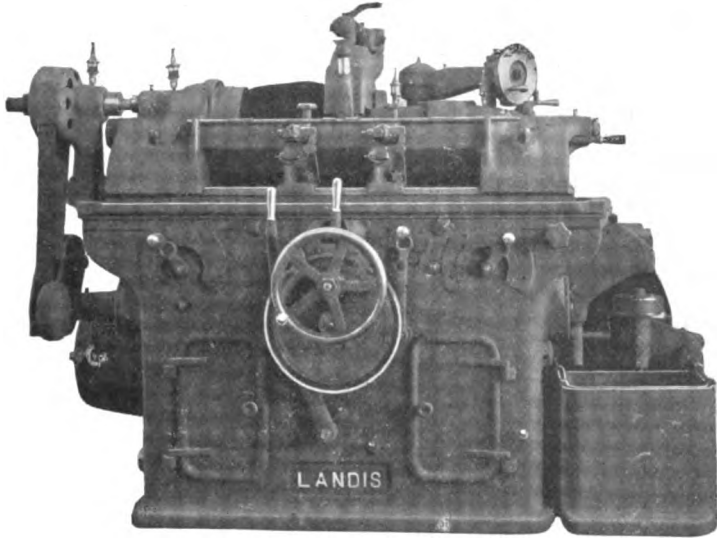
Electric welding is the only correct method. Why?

Because the heating begins inside and travels to the outside; when it is visibly welded on the outside, it is sure to be welded on the inside.

LANDIS TOOL COMPANY

WAYNESBORO, PA.

Manufacturers of Precision Cylindrical Grinding Machines



Improved Self-Contained Grinding Machine

Our regular line consists of the following types:

UNIVERSAL MACHINES No. 1, No. 1½, No. 2, No. 3, No. 4 (Nos. 2, 3 and 4 are also built with 16" swing) are used for finishing tools and a variety of straight or taper parts, both external and internal, such as are common to the tool room, machine shop, railroad shops, etc.

Attachments, such as magnetic chuck, gear-cutter attachment, side mill grinding attachment, etc., can be used on these machines to advantage.

PLAIN GRINDING MACHINES. Sizes 6", 10", 12", 20", 30", 40" swings in standard lengths. These strictly manufacturing machines are intended for finishing straight and taper spindles, shafts, rolls, tubing and all other work which can be revolved on dead centers.

PLAIN GRINDING MACHINES WITH GAP are our 16" and 20" swing. Plain Machines, built with gap in the bed to suit the location of the projection on the work. Especially suitable for grinding locomotive piston rods.

INTERNAL GRINDING MACHINE for straight and taper internal grinding and the fixtures for these machines will grind holes ¼" in diameter, or larger, and up to 12" long.

CRANK GRINDING MACHINE for grinding single or multiple throw crank shafts used in gas and small steam engines.

ROLL GRINDING MACHINES for grinding chilled iron and hardened steel rolls.

CAM GRINDING ATTACHMENTS (for use on our plain and universal grinders) for grinding either detachable or integral cams.

BALL BEARING RACE GRINDING MACHINE for grinding the raceways in radial, thrust and cone ball bearings.

Our illustrated and descriptive catalogue and literature gives detailed information. It also describes the features which stand for quick manipulation, accurately finished work, durability of alignments and rapid production—all of which are prominent in the various types of Landis Grinding Machines.

LANDIS

TRADE MARK

MODERN TOOL COMPANY

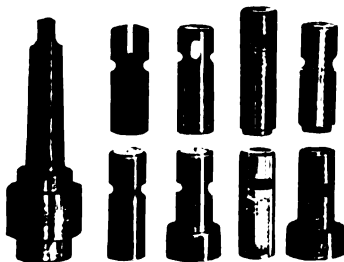
ERIE, PENNA., U. S. A.

Manufacturers of Plain, Universal and Internal Grinding Machines, Self-Opening Dies, Collapsible Taps and Quick Change Chucks

"MODERN" SELF-OPENING DIES AND COLLAPSIBLE TAPS



"Modern" Threading Tools are universal in their application and use, being adapted for revolving spindles as well as turret lathes and screw machines. A single style of Die or Tap will cut any form or pitch of thread, of any diameter within the capacity of the respective heads. "Modern" Die Heads are made in sizes to thread any diameter from $\frac{1}{8}$ " to 6", and the range of "Modern" Collapsible Taps is from $\frac{1}{2}$ " to 3".



"Magic" Chuck and Collets

"MAGIC" CHUCK EQUIPMENT

For the rapid changing of tools in drill press, lathe, screw machine, etc., without stopping the machine, practically converting a single spindle machine into a multiple spindle one, with as many tools as you may have operations. Made in six sizes, the largest with capacity up to 5" diameter drills. Try it and save labor costs.

"MODERN" GRINDING MACHINES

"Modern" Self-Contained Grinding Machines have a single constant speed drive, which reduces the cost when equipping the machines with motors. The main drive is in the rear of the machine and power is applied either from the line shaft by a single belt or by motor connection.

"Modern" Plain Type, Self-Contained Grinding Machines are made in sizes ranging in capacity from 18" to 60" between centers, and up to 16" swing.

"Modern" Self-Contained Crank Grinding Machines are adapted for grinding and finishing single and multiple throw crank shafts, including those used in the manufacture of gas engines or motors for automobiles and launches.

The above types are strictly manufacturing machines, designed to withstand the class of service required of grinding machines of this character, and embody many new and improved features which enable them to produce accurate, highly finished parts, rapidly and economically.

Send for illustrated literature.

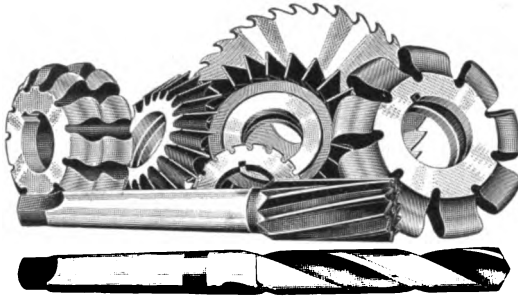


"Modern" 8" x 30" Plain Self-Contained Grinding Machine

UNION TWIST DRILL CO.

ATHOL, MASS.

Manufacturers of Twist Drills, Gear and Milling Cutters



MILLING CUTTERS OF ALL DESCRIPTIONS

We have had long experience in the manufacture of cutters and concentrating our energy on this class of tools enables us to offer a product which in quality of material and workmanship is strictly high grade.

Our cutters are very carefully made, and all are thoroughly tested as to shape, size, and temper before leaving our works. Teeth are spaced to give the most desirable results and are strong and well proportioned to withstand heavy cuts.

GEAR AND FORMED CUTTERS

Formed cutters for the production of duplicate parts are made to order of any desired shape, and are most economical to use for irregular outlines. It is possible to make special cutters, gangs, milling cutters of all descriptions, and formed cutters for a wide variety of work.

Such cutters are particularly valuable for use in manufacturing duplicate parts owing to that feature which makes it possible to sharpen them by grinding the faces of the teeth without changing the form.

TWIST DRILLS AND REAMERS

**COMPLETE EQUIPMENT FOR MANUFACTURE OF SPECIAL TOOLS
IN ALL THESE LINES.**

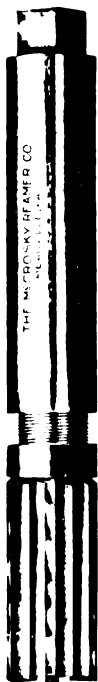
Complete catalogue and Book of Information on Request.

THE McCROSKY REAMER CO.

MEADVILLE, PA.

Manufacturers of Adjustable Reamers, Expanding Mandrels, Turret Tool Posts, Wizard Quick-change Chucks and Collets, Wizard Variable Speed and Reversing Attachment for drill press, Searchlight Universal Lamp Brackets for shop and drafting room, and Other Cost-Cutting Specialties

McCROSKY ADJUSTABLE REAMERS

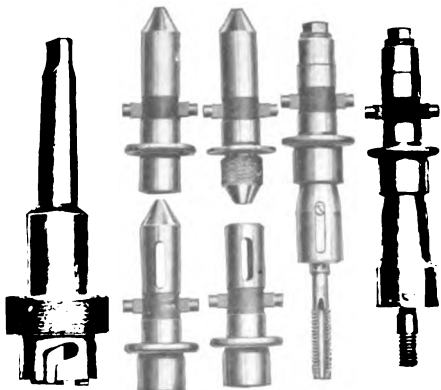


If you are in any way personally responsible for reaming results in your shop, you should familiarize yourself with this line of reamers. All styles and sizes from $\frac{1}{4}$ " to 10". High speed or carbon. Unequaled in design, unexcelled in workmanship and material, combining all the advantages of both solid and adjustable reamers without the disadvantages of either.

Hundreds of the largest and best shops have adopted these reamers as standard equipment. We solicit the privilege of figuring on your requirements.

WIZARD QUICK-CHANGE CHUCKS AND COLLETS

will revolutionize any drill press job where it is desired to use more than one tool in succession. Takes all sizes and kinds of tools, such as drills, taps, reamers, special tools, etc., in rapid succession without stopping the machine. On many



jobs will show 50% saving. Embodies several important features not found in any similar device. Wizard friction drive collets are unequaled for tapping and stud setting. Wizard No-Need-a-Tang collets reclaim broken tang drills and forever end all tang troubles.

Try a Wizard outfit on thirty days approval and watch it make dollars for you. We take the risk.

Our complete catalog of cost-cutting tools sent on request.

THE McCROSKEY REAMER CO.

F-P-M TURRET TOOL POSTS FOR LATHES

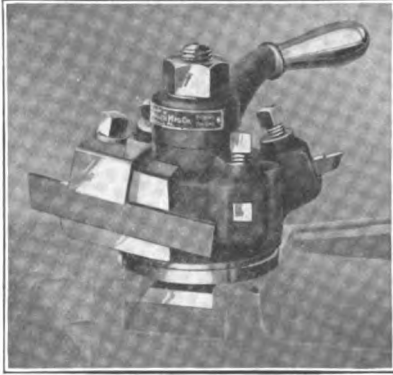


Illustration above shows Style C Turret. Made in four sizes, taking $\frac{1}{16}$, $\frac{3}{16}$, $\frac{7}{16}$ and $\frac{1}{2}$ " sq. bits. Cut-off tool may be removed and an extra sq. bit inserted. Style D Turret (not shown) is same as Style C except that it is 3-cornered, carrying 3 tools instead of 4.

Illustration opposite shows Style E Turret for inside work such as drilling, reaming, etc. Diameter of Turret $6\frac{1}{2}$ ". Holes any diameter up to $1\frac{1}{4}$ ".

Catalog on request.

Converts any ordinary lathe into a Turret Lathe.

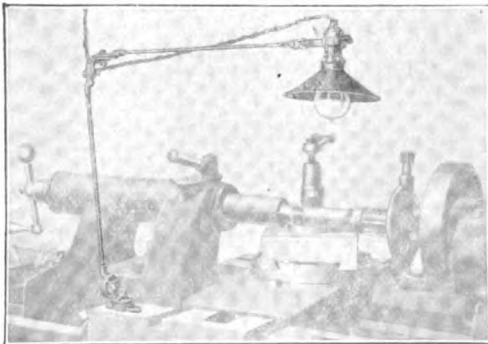
Attached directly to compound rest as quickly and easily as ordinary tool post. Has positive, accurate indexing device operated automatically with tightening and loosening of clamping handle.

Simple, strong and inexpensive. Advantages found in no other line of turret attachments. Will fit almost any lathe.



247

THE SEARCHLIGHT LAMP BRACKET



Completely universal. Made in various styles to suit all factory and shop conditions. Puts the light where you want it when you want it. More output, better work, happier men. Saves globes. Only \$1.50 each with liberal discount according to quantity.

THE CARBORUNDUM COMPANY

NIAGARA FALLS, N. Y.

NEW YORK

CHICAGO

BOSTON

PITTSBURGH

PHILADELPHIA

CLEVELAND

CINCINNATI

MILWAUKEE

LONDON, ENG.

Manufacturers of Abrasive Materials, Carborundum and Aloxite Grinding Wheels, Carborundum Paper and Cloth, Aloxite Cloth, Carborundum Brand Garnet Paper, Carborundum Sharpening Stones

CARBORUNDUM GRINDING WHEELS

FOR cast iron, brass, bronze, aluminum, general machine shop work, for cylindrical, internal or surface grinding of metals of low tensile strength, for grinding pearl, marble, granite and porcelain.

ALOXITE GRINDING WHEELS

FOR steel grinding, malleable iron, reamers, cutters, drills, planer tools, knife grinding, cylindrical, internal or surface grinding where the material is steel.

Made in any standard shapes or sizes, or in any special shapes or sizes, subject to blueprints.

THE RIGHT WHEEL IN THE RIGHT PLACE

This is the secret of efficient and economical grinding. Our service department is at your command to give you the benefit of years of experience in all classes of grinding—to give you proper wheel-right grit, right grade. Let us know about your grinding conditions—there is a Carborundum or Aloxite wheel to meet every grinding condition.

Performances—things actually done by Carborundum and Aloxite wheels—are the most convincing arguments in favor of their merits. Send for these illustrated records—they are shown in our "Efficiency Booklet." Let us arrange to send you a trial wheel. We can better your grinding conditions.

NORTON COMPANY

WORCESTER, MASS., U. S. A.

NEW YORK STORE
151 Chambers St.

Bauxite Plant
BAUXITE, ARK.

CHICAGO STORE
11 N. Jefferson St.

Electric Furnace Plants
NIAGARA FALLS, N. Y.—CHIPPAWA, CAN.

Manufacturing Plants
WORCESTER, MASS.—WESSELING, GERMANY

Manufacturers of Alundum and Crystolon Grinding Wheels, Alundum and Crystolon Grain for Polishing, Alundum Refractories and Laboratory Ware, Glass Cutting Wheels, India Oil Stones and Crystolon Sharpening Stones, Razor Hones, Scythe Stones, Valve Grinding Compound, Rubbing Bricks and Stones, Grinding Wheel Dressers, and Grinding Machinery

ALUNDUM (Al_2O_3) is an artificial abrasive whose hardness, sharpness and toughness are under control during manufacture. This, in combination with its characteristic conchoidal fracture, makes Alundum Grinding Wheels particularly effective upon materials of high tensile strength—notably steel and its alloys.

CRYSTOLON (SiC) is another product of the electric furnace and because of its wonderful purity and remarkable cutting qualities, combined with its greater brittleness, this abrasive has proven highly efficient in grinding cast iron, brass, bronze, aluminum, glass, marble, pearl, and materials of like physical characteristics.

NORTON GRINDING WHEELS are made by four processes: the vitrified, silicate, elastic and vulcanite. In the vitrified process, the principal bonding ingredient is clay; in the silicate, sodium silicate is largely used; in the elastic process, the bond is made from a special mixture of shellac and other ingredients; while in the vulcanite process, a special form of vulcanized rubber is utilized.

Wheels can be furnished in various shapes and sizes to meet grinding requirements. Sizes run from as small as $\frac{1}{8}$ " diameter to as large as 60" diameter, while the thinnest wheels made are $\frac{1}{8}$ " thick, and the widest faced 28" thick. All wheels larger in diameter than 5" are subjected to a severe mechanical test before shipment to bring out any inherent weakness.

Wheels are classified by grain and grade, the grain numbers indicating the size of the abrasive cutting particles, while the grade denotes the measure of strength of the bond, or binding material in the wheel which holds the grain in its setting.

REFRACTORIES—Owing to the high refractory properties possessed by alundum this substance has been found unequalled for the manufacture of refractory and laboratory ware. Alundum is made into electric furnace cores, tubes, muffles, crucibles, combustion boats, filtering crucibles, cones, extraction thimbles and refractory cements.

GLASS CUTTING WHEELS—One of the most recent products developed by Norton Company is an assortment of Alundum glass cutting stones. These stones are of even texture throughout and possess no hard or soft spots, no sand holes or other defects. Every stone is true to mitre and they will produce a sharp, clean cut; cut faster and last longer than any natural stone.

Any of these Booklets will be sent on request

Grinding Wheel Catalog
Alundum-Crystolon Booklet
Polishing—What to Use—How to Use It
Norton Refractories—Alundum and Crystolon
Alundum and Crystolon in the Glass Industry

Norton Valve Grinding Compound
Safety as Applied to Grinding Wheels
Grinding Wheel Dressers
Grinding Wheels for the Saw Mill

SPECIAL RESEARCH SERVICE—We have well-equipped research laboratories with a competent staff of research engineers and demonstrators who are always ready to give you the benefit of their special knowledge and wide experience in the solving of your special problems.

Alundum
TRADE MARK



Crystolon
TRADE MARK

THE HOGGSON & PETTIS MFG. CO.

NEW HAVEN, CONN., U. S. A.

THE SWEETLAND INDEPENDENT CHUCKS

PRICE LIST, DIMENSIONS, ETC.

Code	Size	Size of Hole	Diameter of Recess for Face Plate	Weight	Price
fable	4 1/2 in.	1 in.	4 1/2 in.	7 lbs.	\$ 14 00
fabric	6 in.	1 1/2 in.	5 1/2 in.	12 lbs.	18 00
facade	8 in.	1 3/4 in.	4 3/4 in.	28 lbs.	22 00
facile	9 in.	1 3/4 in.	5 1/2 in.	32 lbs.	24 00
facet	10 in.	2 in.	5 1/2 in.	42 lbs.	26 00
faction	12 in.	2 1/2 in.	6 1/2 in.	67 lbs.	30 00
faculty	14 in.	3 in.	6 1/2 in.	84 lbs.	34 00
fagot	16 in.	3 in.	7 1/2 in.	117 lbs.	38 00
faiin	18 in.	4 in.	9 in.	157 lbs.	44 00
falcon	20 in.	4 1/2 in.	9 1/2 in.	184 lbs.	50 00
fame	22 in.	5 in.	11 in.	217 lbs.	57 00
fancy	24 in.	5 in.	11 in.	247 lbs.	65 00
fashion	26 in.	5 in.	12 in.	315 lbs.	80 00
fastness	28 in.	5 in.	13 in.	350 lbs.	100 00



DIMENSIONS

OF ALL

GEARED SCROLL CHUCKS

Numbers 6, 60, 61, 62, 63, 64, 65 and 66

Size	Net Weight Approx 1 Set Jaws		Gross Weight Approx 1 Set Jaws		Net Weight Approx Per Set		Size of Hole	Diameter of Recess for Face Plate	Will Hold	Diameter of Swing
	3 Jaws	4 Jaws	3 Jaws	4 Jaws	3 Jaws	4 Jaws				
2 1/2			2				1 1/2	1 1/2	2 1/2	2 1/2
3			3 1/2	4			2 1/2	3 1/2	3 1/2	3 1/2
4	7 1/2	7 1/2	7 1/2	7 1/2	8	1	3	4 1/2	4 1/2	4 1/2
5	10 1/2	11	11	11 1/2	1 1/2	1 1/2	1 1/2	3 1/2	5 1/2	5 1/2
6	16 1/2	16 1/2	17 1/2	17 1/2	1 1/2	3	1 1/2	4 1/2	6 1/2	6 1/2
7 1/2	26	28 1/2	29	31 1/2	3	4	2	4 1/2	8 1/2	8 1/2
9	38	40	41	46 1/2	3 1/2	5 1/2	2 1/2	5	10 1/2	10
10 1/2	53	53 1/2	61	61 1/2	5 1/2	7 1/2	3	5 1/2	11 1/2	11 1/2
12	69	73 1/2	81	85	8	11 1/2	3 1/2	6 1/2	13	12 1/2
15	114	117	128	131	8	12	3 1/2	6 1/2	16	15 1/2

REVERSIBLE JAWS ARE STYLES No. 6' and 60
COMMON " " " " No. 61 and 62
REVERSE " " " " No. 63 and 64

THREE JAW CHUCKS Styles No. 6, 61, 63

Code	Size	Price
ingot	2 1/2 in.	\$ 7 50
inhale	3 in.	10 00
inlet	4 in.	12 00
install	5 in.	15 00
issue	6 in.	18 00
inward	7 1/2 in.	20 00
inveigh	9 in.	24 00
inveet	10 1/2 in.	27 00
insight	12 in.	30 00
insipid	15 in.	40 00

FOUR JAW CHUCKS Styles No. 60, 62, 64

Code	Size	Price
inlaid	3 in.	\$10 75
inmate	4 in.	13 00
inmost	5 in.	16 20
indorse	6 in.	19 50
induce	7 1/2 in.	21 00
indulge	9 in.	26 00
incense	10 1/2 in.	29 10
india	12 in.	32 40
indigo	15 in.	43 30

TWO SETS OF JAWS ARE STYLES No. 65 and 66

THREE JAW CHUCKS Style No. 65

Code	Size	Price
ingulf	2 1/2 in.	\$ 9 00
inject	3 in.	12 00
insist	4 in.	14 40
instep	5 in.	18 00
iris	6 in.	21 60
invest	7 1/2 in.	24 00
inverse	9 in.	28 80
intrude	10 1/2 in.	32 40
inform	12 in.	36 00
infrict	15 in.	48 00

FOUR JAW CHUCKS Style No. 66

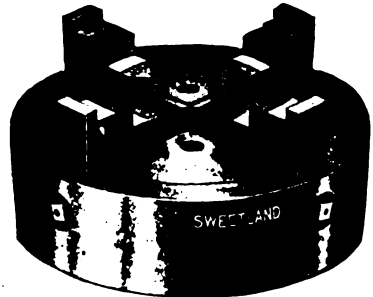
Code	Size	Price
incaise	3 in.	\$13 35
inboard	4 in.	16 20
incaise	5 in.	20 20
incise	6 in.	24 30
inclose	7 1/2 in.	26 90
incline	9 in.	32 40
incrust	10 1/2 in.	36 40
incur	12 in.	40 40
incurvate	15 in.	54 00

THE HOGGSON & PETTIS MFG. CO.

SWEETLAND COMBINATION LATHE CHUCKS



WITH REVERSIBLE JAWS

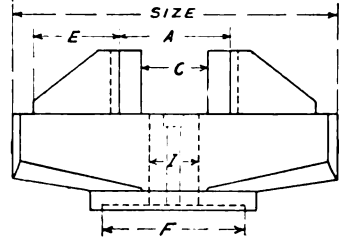
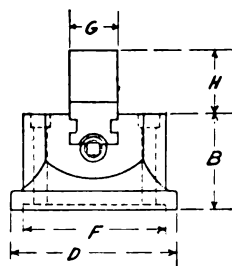


WITH COMMON JAWS

These Chucks Can Be Furnished From Stock
With Three or Four Jaws as Desired

Size	Net Weight Approx.		Gross Weight Approx.		Diameter or Swing	Will Hold	Size	Diameter of Recess for Face of Plate	Price List	
	3 Jaw	4 Jaw	3 Jaw	4 Jaw					Three Jaw	Four Jaw
In.	Lbs.	Lbs.	Lbs.	Lbs.	In.	In.	In.	In.		
4	7	....	9	....	5 1/2	4 1/2	1	3	\$ 22 00	\$
6	20	21	23	24	8	6 1/2	1 1/4	3 1/8	26 00	32 00
9	33	36	41	44	10 1/2	9 1/2	1 1/2	5	34 00	42 00
12	60	65	73	78	13 3/4	12 1/4	1 3/4	5 7/8	44 00	56 00
15	80	84	94	98	16 1/4	15 1/4	1 3/4	5 7/8	52 00	64 00
18	110	116	129	135	19	18 1/2	2	9	62 00	75 00
21	125	147	148	168	22 3/4	21 1/2	2 1/4	9	80 00	95 00
24	145	162	170	187	25 3/4	24 1/2	2 1/2	9	100 00	120 00
30	332	383	379	430	32	30 1/2	4 1/2	12 1/4	170 00	200 00
36	465	529	484	540	38 1/2	36 1/2	4 1/2	12 1/4	230 00	285 00
42	610	640	675	700	44 1/2	42 1/2	4 1/2	24	270 00	325 00

THE SWEETLAND BOX BODY CHUCK



Size	Weight each	A	B	C	D	E	F	G	H	I	Code	Price
in.		in.	in.	in.	in.	in.	in.	in.	in.	in.		
5	14 lbs.	1 3/4	2 3/4	1 1/2	5	1 5/8	3 1/4	1 1/2	1 3/8	1	each	\$16.00
6	17 lbs.	2	3	1 3/2	4 1/2	2	3 1/4	1 3/4	1 1/2	1 1/2	eager	20.00
7	20 lbs.	3	3	1 1/2	4 1/2	2	3 1/4	1 3/4	1 3/4	1 3/4	eared	24.00
9 1/2	38 lbs.	4	3 1/4	2 1/4	5 5/8	2 3/4	4 3/4	2	2 1/4	2	earl	30.00
12	50 lbs.	6	3 3/4	4	6	3	5	2 1/4	2 3/4	2 1/4	earth	36.00
15	75 lbs.	8	4 1/2	6	7 3/4	3 1/2	6 1/4	2 1/4	3	2 1/4	easel	42.00
18	100 lbs.	10	4 1/2	8	7 3/4	4	6 1/4	2 1/4	3 1/2	2 1/4	eavse	60.00

Can be Furnished as Universal or Independent. Slip Jaws, Tool or Soft Steel

(Continued on next page)

(Continued from preceding pages)

THE HOGGSON & PETTIS MFG. CO.

NEW HAVEN, CONN.

HAND CUT STEEL LETTERS AND FIGURES



The proper grade of steel is used in the construction of these hand cut steel figures and letters. A size suitable for the letter to go on it is used, and is long enough so it can be held without hitting the fingers.

Size.....inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{4}$
Price, Figures per set	2.50	2.00	1.50	1.50	1.50	1.50	1.50	1.50	2.00
" Letters "	7.50	6.00	4.50	4.50	4.50	4.50	4.50	5.25	6.00
" " or Figures, ea.	.35	.30	.20	.20	.20	.20	.20	.25	.30

Size.....inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1
Price, Figures per set	2.20	2.35	2.85	3.35	4.20	4.70	6.80	9.40	12.95	15.70
" Letters "	6.50	7.00	8.50	10.00	12.50	14.00	20.40	28.20	38.75	47.00
" " or Figures, ea.	.30	.35	.40	.45	.60	.65	.80	1.10	1.45	1.75

252

MARKING ROLL

HAND CUT STEEL STAMPS



HAND CUT STEEL STAMPS

Of all kinds and for all purposes. The work is all strictly hand cut, the letters being correctly shaped and the stamps properly tempered to suit the work they are to do. Price list is for plain letter hand stamps only.

Size.....inches	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	1	
Price...per letter	.20	.20	.15	.15	.15	.15	.15	.15	.18	.20	.20	.25	.30	.40	.45	.50	.75	1.00	1.25	1.50

Stamps with letters over $\frac{1}{8}$ inch will be charged extra at the rate of 50 cents per pound for steel and forging.

MARKING ROLLS AND MACHINE STAMPS

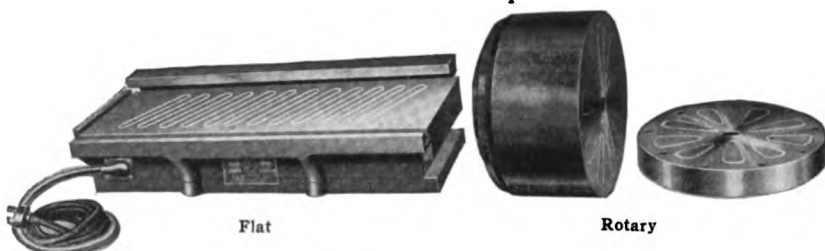
Estimates cheerfully given for machine stamps and marking rolls, completing or for cutting same only. Also for fancy lettering and special designs; stamps for difficult places and shapes.

D & W FUSE COMPANY

PROVIDENCE, R. I.

"D & W" MAGNETIC CHUCKS

Oil-Proof and Waterproof



Flat

Rotary

"D & W" magnetic chucks are so designed as to make possible a wider range of work than has heretofore been considered practicable. This is effected by the use of a special form of narrow pole pieces made of mild steel. With this design a maximum effective holding surface is secured together with an exceptionally strong and uniform pull throughout.

The magnet coils in "D & W" chucks are wound with Deltabeston wire, having a special heat-proof insulation of pure asbestos, which we manufacture. This insulation can safely withstand temperatures as high as 400° Fahr. In addition, the coils are wound by a special process which further protects them from heat and moisture. This eliminates the expense of burnt-out coils.

The flat chucks are equipped with adjustable end and side stops, providing convenient means for locating and steadying the work on the surface of the chucks.

The above illustration of the rotary chuck shows same with an auxiliary plate. These plates are used as jigs or fixtures for the holding of special or irregular shaped pieces. By means of these plates, one chuck can be made to cover a wide range of operations, as any number of plates can be used with one chuck. All chucks are designed to operate on direct current circuits up to 250 volts.

Magnetic chucks can only be operated on direct current circuits.

In ordering chucks specify the voltage of lighting circuit.

FLAT

Style	Extreme Holding Face	Extreme Base Dimension	Height	Price Each
F-7-8	8 $\frac{1}{4}$ x 7	8 $\frac{1}{4}$ x 6	4	\$ 55.00
F-6-13	13 x 5 $\frac{1}{2}$	13 x 4 $\frac{1}{2}$	3 $\frac{1}{2}$	55.00
F-7-16	16 $\frac{1}{2}$ x 7	16 $\frac{1}{2}$ x 6 $\frac{1}{2}$	3 $\frac{1}{2}$	77.00
F-8-20	20 $\frac{1}{2}$ x 9 $\frac{1}{2}$	20 $\frac{1}{2}$ x 8	3 $\frac{1}{2}$	110.00
F-10-31	31 $\frac{1}{2}$ x 10 $\frac{1}{2}$	31 $\frac{1}{2}$ x 9 $\frac{1}{2}$	4 $\frac{1}{2}$	148.00
F-13-21	21 x 13 $\frac{1}{2}$	21 x 12	4 $\frac{1}{2}$	132.00
F-13-33	33 $\frac{1}{2}$ x 13 $\frac{1}{2}$	33 $\frac{1}{2}$ x 12	4 $\frac{1}{2}$	178.00
F-10-46	46 $\frac{1}{2}$ x 10 $\frac{1}{2}$	46 $\frac{1}{2}$ x 9 $\frac{1}{2}$	4 $\frac{1}{2}$	Special

ROTARY

Style	Diameter	Width to Face Plate Seat	Diam. of Each Plate Seat	Price Each
R-3	4 $\frac{1}{2}$	2 $\frac{1}{2}$	5 Morse Taper	\$33.00
R-6	6	3 $\frac{1}{2}$	4	44.00
R-8	8	3 $\frac{1}{2}$	4 $\frac{1}{2}$	55.00
R-10	10	3 $\frac{1}{2}$	5	72.00
R-12	12	4 $\frac{1}{2}$	5	94.00
R-14	14	4 $\frac{1}{2}$	7	Special
R-16	16	4 $\frac{1}{2}$	7	"
R-18	18	4 $\frac{1}{2}$	8	"
R-20	20	4 $\frac{1}{2}$	8	"
R-24	24	5	10	"

Complete catalogue mailed upon request.

THE CINCINNATI BALL CRANK CO.

CINCINNATI, OHIO

BRANCH OFFICE: 1316 Dime Bank Bldg., DETROIT, MICH.

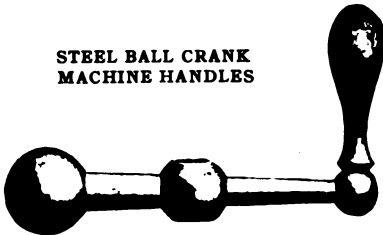
Manufacturers of Steel Products

HANDLES FROM STEEL

For power tools and similar purposes

Milled from the bar, drilled, faced and key-wayed to specifications. Highly finished, accurate, complete on receipt and ready to attach.

**STEEL BALL CRANK
MACHINE HANDLES**



**COMPOUND
REST
HANDLES**



No.	Length Over All	Center Ball	Large End Ball	Small End Ball
0	3	7/8	1	5/8
1	3 1/2	1	1 1/8	3/4
1 1/2	4	1 1/8	1 3/8	7/8
2	4 1/2	1 1/4	1 3/4	7/8
3	5	1 3/8	1 1/2	1
4	5 1/2	1 3/4	1 1/2	1
5	6	1 3/4	1 3/8	1
6	6 1/2	1 3/8	1 3/4	1
7	7	1 1/2	1 3/4	1
8	7 1/2	1 1/2	1 3/4	1
9	8	1 1/2	1 3/4	1 1/8
10	8 1/2	1 1/2	1 3/4	1 1/8
11	9	1 5/8	1 3/4	1 3/8
12	11	1 3/4	1 7/8	1 1/4
13	13	1 1 1/2	2	1 1/4

Center ball can be drilled and faced any size desired.

No.	Length Over All	Center Ball	End Balls	
1	2 1/2	1 1/8	3/4	No handle in ends
2	2 1/2	1 1/8	3/4	Handle in one end
3	2 1/2	1 1/8	3/4	Handle in both ends
4	3	1 1/8	3/4	No handle in ends
5	3	1 1/8	3/4	Handle in one end
6	3	1 1/8	3/4	Handle in both ends
7	3 1/2	1 1/8	3/4	No handle in ends
8	3 1/2	1 1/8	3/4	Handle in one end
9	3 1/2	1 1/8	3/4	Handle in both ends
10	4	1 1/8	7/8	No handle in ends
11	4	1 1/8	7/8	Handle in one end
12	4	1 1/8	7/8	Handle in both ends

Center ball can be drilled and faced any size desired.

MACHINE HANDLES



No.	Length of Shank	Length Over All	Diameter of Shank
000	1 1/2	1 1/2	1 1/4
00	1 1/2	2	1 1/4
0	1 1/2	2 1/4	1 1/4
1	5/8	2 3/4	1 1/4
2	3/4	3 1/8	1 1/4
3	3/4	3 1/2	1 1/4
4	3/4	4	1 1/4
5	7/8	4 3/8	1 1/4
6	1	4 5/8	1 1/2
7	1	5 1/8	1 1/2
8	1 1/4	5 3/4	5/8

TWO BALL LEVERS

Adapted for Tail Stock, Tighteners, Drill Press Clamps, Back Gear Levers, and for all similar purposes.



No.	Length Over All	Large End Ball	Small End Ball
2	4 1/2	1 3/4	3/4
4	5 1/2	1 1/2	1
6	6 1/2	1 3/4	1
8	7 1/2	1 3/4	1 1/4
10	8 1/2	1 3/4	1 1/4
11	9	1 3/4	1 1/4

Large ball can be drilled and faced any size desired.

Manufactured as a specialty and sold below the manufacturing cost of cast iron or forged handles.

THE CHAMPION RIVET CO.

Established 1895

CLEVELAND, OHIO

Manufacturers of Boiler, Ship, Structural and Tank Rivets

VICTOR STEEL RIVETS

The Champion Rivet Company invites the closest inspection of the quality of Open Hearth Steel used in the manufacture of Victor Rivets, and we have given in our catalog fac-simile of chemists' reports and tests from laboratories of the highest standing.

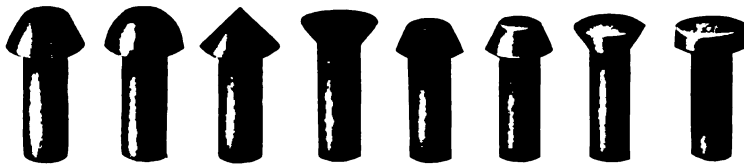
Open Hearth Steel fulfills every requirement for a rivet steel. This is amply proved by the use of Victor Rivets in the most important works, and by the numerous tests which we offer in our catalog.

ACTUAL RESULTS OF TESTS

Showing the Physical Qualities of Victor Steel Rivets

Sample Mark	Diam. of Bar in inches	Elastic Limit in pounds per square in.	Ultimate Tens. Strength pounds per sq. in.	Elongation in 8 ins. per cent	Reduction of Area per cent	Character of Fracture
Steel Rivet Bar No. 1.....	1.100	38210	49840	35.0	61.7	Silky
" " " " 2.....	1.100	37650	50880	35.	62.3	"
" " " " 3.....	.895	32430	46735	31.2	62.9	"
" " " " 4.....	.985	33532	54320	33.7	66.5	"
" " " " 5.....	.735	37720	55070	33.7	66.5	"
" " " " 6.....	.605	43150	53540	29.5	66.6	"
" " " " 7.....	.480	40630	50030	32.5	62.2	"
" " " " 8.....	.675	34090	51710	28.	64.9	"
" " " " 9.....	.670	33760	53190	30.7	72.7	"
" " " " 10.....	.855	31350	50340	30.	67.1	"
Steel Rivet No. 1.....	.855	33710	55380	....	65.8	"
" " " " 2.....	.855	35220	55300	....	67.8	"

255



Standard Heads of Large Rivets

Standard Heads for Small Rivets made in Cone, Button, Tank Pan, Flat Countersunk, Oval Countersunk, Flat and Wagon Box types. We are now making Sheet Iron Rivets of this type smaller than $\frac{1}{2}$ " diameter. We are also prepared to make these small rivets with special heads of all kinds.

Standard Heads of Large Rivets made in Cone, Button, Steeple, Flat Countersunk, Pan Head Swell Neck, Pan Head Straight Neck, Oval Countersunk, Flat Head types. Special types, heads, etc., can be made to meet the requirements or ideas of any consumer as might be outlined.

Victor Boiler Rivets conform strictly to the Standard Specifications for Boiler Rivet Steel adopted by the American Society for Testing Materials, both as regard physical and chemical tests.

The fourth edition of our book, "Scientific Facts and other Valuable Information Relative to Victor Boiler, Structural Ship and Tank Rivets," contains more valuable, scientific and original information than has been published in book form—yours for the asking.

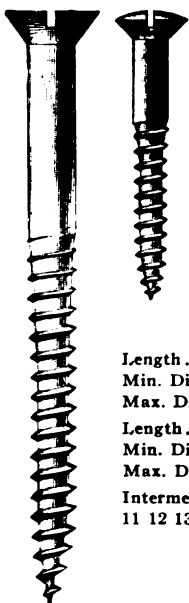


AMERICAN SCREW COMPANY

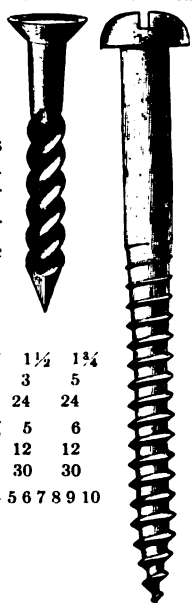
PROVIDENCE, R. I.

Makers of Wood Screws, Machine Screws, Stove Bolts, Tire Bolts, Rivets, etc.

Flat Head Oval Head



Drive Screw Round Head



WOOD SCREWS

Flat and Round Head Wood Screws are regularly made in Iron in the following sizes, and in Brass in sizes of approximately the same variety; other kinds of Wood Screws are made in the sizes commonly used.

Length....	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$
Min. Dia...	0	1	1	2	2	3	3	3	3	5
Max. Dia...	4	9	12	14	16	16	20	24	24	24
Length....	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{2}$	4	$4\frac{1}{4}$	5	6
Min. Dia...	5	5	5	6	6	8	8	12	12	12
Max. Dia...	24	24	24	24	26	26	30	30	30	30

Intermediate diameters advance as follows: No. 0 1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 20 22 24 26 28 30

MACHINE SCREWS

Flat, Round, and Fillister Head Machine Screws are regularly made in Iron in the following sizes, and in Brass in sizes of approximately the same variety:

Length...	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{1}{8}$	1	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{2}$
Min. Dia.	2	2	2	2	2	2	2	2	2	4	4	4	4	4
Max. Dia.	10	14	16	24	24	24	24	24	34	34	34	34	34	34
Length...	$1\frac{1}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{3}{4}$	4				
Min. Dia.	4	4	5	7	7	7	9	9	4	4				
Max. Dia.	34	34	34	34	30	30	30	30	30	30				

Intermediate diameters advance as follows: No. 2 3 4 5 6 7 8 9 10 12 14 16 18 20 24 30 34

Flat Head



Round Head



Fillister Head



Diameter No.	2	3	4.5	6	7	8	9.10	12	14
Threads per in.	48.56.64	48.56	32.36.40	30.32.36	30.32	30.32.36	24.30.32	20.24	18.20.24
	16.18	20	24	30	34				
	16.18.20	16.18	14.16.18	14.16	13				

Regular Side Knob Screws  are $\frac{3}{8}$ inch No. 9, 24 thread.

AMERICAN SCREW COMPANY

STOVE BOLTS



Flat and Round Head Iron Stove Bolts are regularly made in the following sizes:

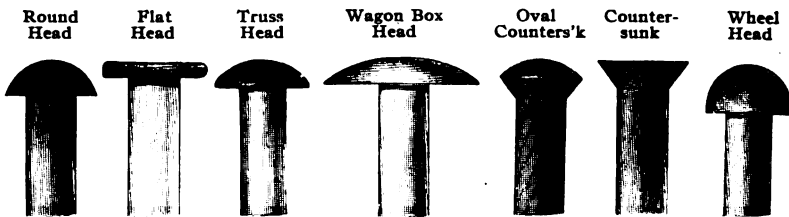
Diameter.....	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{2}$
Min. Length.....	$\frac{3}{4}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
Max. Length.....	2	2	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$1\frac{1}{2}$

The length advances by eighths of an inch from $\frac{3}{8}$ to $\frac{1}{2}$, then by quarters to $6\frac{1}{2}$.

STOVE RODS

Stove Rods are the same as Stove Bolts in every respect excepting length. They are regularly made in Iron of $\frac{1}{8}$ and $\frac{1}{4}$ diameter in length from 7 to 40", advancing by halves of an inch.

RIVETS



Cold-headed Rivets are made in great variety of styles and sizes up to $\frac{1}{4}$ in. diameter and 6 in. length.

MEASUREMENTS

The length includes the head of Flat Head Screws, Stove Bolts, and Stove Rods; excludes the head of Round and Fillister Head Machine Screws and Round Head Stove Bolts and Stove Rods; includes the countersink of Oval Head Screws and about half the head of Round Head Wood Screws, but the practice with regard to Round Head Wood Screws is not uniform with all makers.

The length of Rivets is exclusive of the head for all styles with a right angle under the head, and inclusive of the countersink for countersunk heads.

The diameter of Screws is measured by the American Screw Gauge, the equivalent in inches being:

0 .0578	5 .1236	10 .1894	15 .2552	22 .3474
1 .0710	6 .1368	11 .2026	16 .2684	24 .3737
2 .0842	7 .1500	12 .2158	17 .2816	26 .4000
3 .0973	8 .1631	13 .2289	18 .2947	28 .4263
4 .1105	9 .1763	14 .2421	20 .3210	30 .4526
				34 .5053

The diameter of Rivets is measured by the old Standard Birmingham Wire Gauge, the equivalent in inches being:

000 .425	2 .284	6 .203	10 .134	14 .083
00 .380	3 .259	7 .180	11 .120	15 .072
0 .340	4 .238	8 .165	12 .109	16 .065
1 .300	5 .220	9 .148	13 .095	17 .058
				18 .049

THE MILTON MANUFACTURING CO.

MILTON, PENNA.

Manufacturers of Cold Punched and Hot Pressed Nuts, Wrought Washers, Refined Bar Iron

"MILTON" NUTS

Cold Punched Chamfered Square or Hexagon—Plain Square or Hexagon—Hot Pressed Square or Hexagon (Blank with drilled holes or tapped to Pratt & Whitney Standard)—Semi-finished—Finished, Finished Case Hardened, Slotted and Castle.



From the purchase of the raw materials until the finished product is ready for shipment, the manufacture of "Milton" Nuts is under the constant supervision of men who know, theoretically as well as practically, thus assuring the purchaser of receiving an absolutely uniform Nut, rendering a superlative degree of Efficiency at all times.



Many builders of the most intricate machinery are specifying "Milton" Nuts exclusively, owing to their accuracy, which admits of rigid construction and prevents vibration, at the same time adding mechanical refinement to their machines.



We have faith that, knowing our materials and their uses by technical and practical knowledge, we can meet in our line the highest scientific requirements.

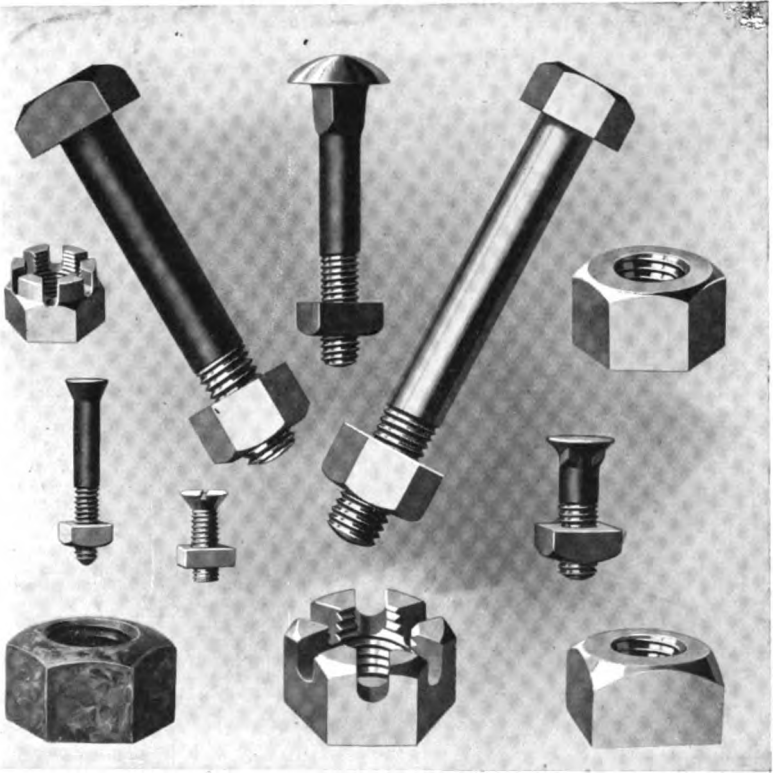


RUSSELL, BURDSALL AND WARD BOLT AND NUT COMPANY

PORT CHESTER, N. Y.

ROCK FALLS, ILL.

Manufacturers of All Kinds of Bolts and Nuts



259

"EMPIRE" BOLTS AND NUTS

Carriage Bolts
Machine Bolts
Coupling Bolts
Stud Bolts
Tap Bolts
Plow and Cultivator
Bolts

Stove Bolts
Tire Bolts
Rivets and Special Bolts
of all descriptions
Cold Punched, Chamfered
and Trimmed Hexa-
gon and Square Nuts

A.L.A.M. Plain and Cas-
tellated Nuts
Master Mechanics' Cas-
tle Nuts
Semi-finished, Full Fin-
ished and Case Hard-
ened Nuts

Our Trade Mark:

"EMPIRE"

signifies a certain standard of excellence that invites your investigation.

NATIONAL LEAD COMPANY

CINCH EXPANSION BOLT DEPARTMENT

111 BROADWAY, NEW YORK CITY

Manufacturers of White Lead, Red Lead, Linseed Oil and Miscellaneous Lead Specialties

CINCH ANCHORING SYSTEM

The Cinch system is a positive method of anchoring based on the wedge, the screw and the lever. The principle employed is scientifically correct. Each anchoring unit, which consists of a malleable iron wedge and a lead ring, forms a perfect, conical truss with the bolt, and these units may be compounded two, three, four or more times to reach or overreach the tensile strength of any bolt. The action is simple, quick and certain.

There are three Cinch anchoring specialties: (a) Cinch Expansion Bolt, (b) Cinch Anchor, (c) Cinch Stud Anchor. They are all a combination of the Cinch expansion units and either a standard machine bolt or a stud bolt.



Cinch Expansion Bolt



Cinch Anchor



Cinch Stud Anchor

These three Cinch anchoring devices are designed to meet every anchoring requirement. They combine the strength of the poured lead anchorage with the ease of installing a practical expansion bolt.

Points of Superiority

1. *Stronger than the Strongest Bolt.* Cinch anchoring devices give the only anchorage guaranteed to hold beyond the tensile and shearing strength of any wrought iron or steel bolt, as well as the breaking strength of the nut. They will not crush or otherwise mar the face of masonry. Vibration will not loosen the grip of the anchorage.

2. *Cut Drilling Costs.* Cinch anchoring devices require a hole of less depth than any other expansion device, affording a great saving of labor and time in drilling, and a substantial saving of material because of the shorter length of bolt needed.

3. *Easy to Install in Any Position.* Cinch anchoring devices are easy to install in any position. They can be set in masonry with the head of the bolt out of or in the hole. When the latter method is followed, expansion can be completed before work is lifted into place and bolted fast.

Installing



Two-Unit Cinch Anchor
after Expansion



Two-Unit Cinch Stud Anchor
after Expansion

The Cinch Expansion Bolt is installed by placing the bolt through the work to be fastened, properly assembling the anchorage on the bolt, holding the work in position and then completing expansion by turning the bolt.

The Cinch Anchor and Cinch Stud Anchor are installed by calking, *i. e.*, bolts are inserted and expansion completed before the work is attached. This method is the most practical for general use and is especially recommended when a heavy object is to be fastened to a side wall or ceiling.



Calking Method of Installing
Cinch Anchor or Cinch
Stud Anchor

Where to Use Cinch Anchoring Specialties

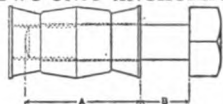
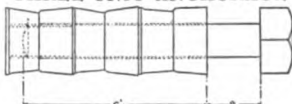
Heavy duty anchoring requirements: Harbor, Water-front, Canal, Railroad and Foundation Work. Anchoring Mooring Heads. Anchoring Rails. Stair Treads. Mining: For fastening trolley lines, cables, pipe, electric wires, etc., to rough rocks, mining trenches, tunnels or shafts. Machinery: Anchoring engines, machinery bed plates and similar heavy work. Fences. Marquises. Signs. Awnings. Theatre Chairs. Factory Equipment. Plumbing, Steam and Gas Fitting. Electrical: For hanging cable lines, aerial and underground, for supporting telephones, chandeliers, fuse boxes, light dishes and brackets, for mounting meter boards and switchboards, for putting up electric signs, etc.

The Cinch Expansion System was used exclusively in anchoring in concrete at the Panama Canal.

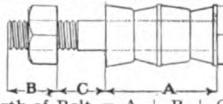
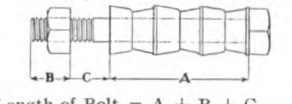
Distribution through jobbers in all large cities. Inquiries directed to Main Office will have immediate and careful attention. Write for catalogue giving full engineering data and specifications.

NATIONAL LEAD COMPANY

Length of Bolt Required for Two-Unit and Three-Unit Cinch Expansion Bolts

TWO-UNIT ANCHORAGE												THREE-UNIT ANCHORAGE											
																							
Length of Bolt = A + B A = Length of Two-Unit Anchorage B = Thickness of work												Length of Bolt = C + B C = Length of Three-Unit Anchorage B = Thickness of work											
Bolt Sizes....	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1"$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1"$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$
Length of A..	$\frac{7}{8}$	$1"$	$1"$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{5}{8}$	2	$2\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{3}{8}$	$2\frac{3}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{1}{4}$	$4\frac{1}{4}$

For length of bolts required add thickness of material to length of Cinch expansion units.
Length of Bolt Required for Two-Unit and Three-Unit Cinch Anchor and Cinch Stud Anchor

TWO-UNIT ANCHORAGE												THREE-UNIT ANCHORAGE											
																							
Length of Bolt = A + B + C A = Length of Two-Unit Anchorage B = Length of Nut C = Thickness of Work												Length of Bolt = A + B + C A = Length of Three-Unit Anchorage B = Length of Nut C = Thickness of Work											
Bolt Sizes....	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1"$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1"$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$
Length of A..	$\frac{7}{8}$	$1"$	$1"$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{5}{8}$	2	$2\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{3}{8}$	$2\frac{3}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{1}{4}$	$4\frac{1}{4}$
Length of B..	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$1"$	$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$1"$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$

For length of bolt required add thickness of material to length of Cinch expansion units and length of nut.

PRICE LISTS

PRICE PER HUNDRED TWO-UNIT ANCHORAGE

Without Bolts. Consisting of 4 Pieces, 2 Irons, 2 Lead Alloys: Units Either Plain or Threaded.

Diameter of Bolt Sizes.....	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1"$
Price per 100 sets, 2 Irons, 2 Leads.....	7.	8.	9.	11.	15.	18.	24.	24.	24.
Minimum depth of holes for 2 Units.....	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Diam. of hole and drill required.....	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

Diameter of Bolt Sizes.....	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$
Price per 100 sets, 2 Irons, 2 Leads.....	35.	44.	63.	140.	150.	220.	220.
Minimum depth of holes for 2 Units.....	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$5\frac{1}{4}$	$5\frac{1}{4}$
Diam. of hole and drill required.....	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$

PRICE PER HUNDRED THREE-UNIT ANCHORAGE

Without Bolts. Consisting of 6 Pieces, 3 Irons, 3 Lead Alloys, Comprising Two Units Plain and One Threaded or Three Units Plain.

Diameter of Bolt.....	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Price per 100.....	10.50	12.	13.50	16.50	22.50	27.	36.
Minimum depth of holes for 3 Units.....	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{3}{4}$	$2\frac{3}{4}$
Diam. of hole and drill required.....	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

Diameter of Bolt.....	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$
Price per 100.....	52.50	66.	94.50	210.	225.	330.	330.
Minimum depth of holes for 3 Units.....	$3\frac{1}{4}$	4	$4\frac{1}{4}$	6	$6\frac{1}{4}$	$7\frac{1}{4}$	$7\frac{1}{4}$
Diam. of hole and drill required.....	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$

The above price lists cover anchorages only. For price lists on complete specialties (i. e., anchorages with bolts) write for complete catalogue.

DIAMOND EXPANSION BOLT CO.

90 WEST ST., COR. CEDAR, NEW YORK

FACTORY: GARWOOD, N. J.

Manufacturers of "Diamond Specialties": Expansion Bolts and Anchors, Drills, Cable and Pipe Clamps, Conduit Rods, etc.

EXPANSION BOLTS

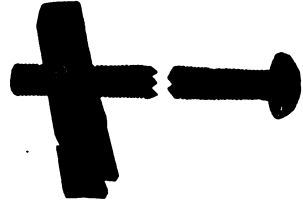


Patented.

"Diamond X" Lag Screw Expansion Shield

A single unit malleable lag screw shield for heavy duty. Enormous displacement of metal at inner end creating great holding capacity.

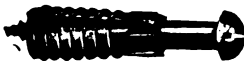
DIAMOND REVERSIBLE TOGGLE BOLTS



For attaching to hollow tile Stucco and all kinds of metal Lathe Walls. Toggles may be used with either the head or nut of stove bolt exposed.



"Diamond N" Expansion Shields—Patented

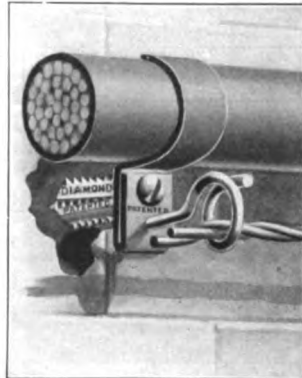


"Diamond N" Screw Anchors—Patented

"Diamond N" Two Part Shields and Screw Anchors are used with a standard lag screw and wood screw threads.

For attaching light and heavy equipment to brick, stone or concrete walls.

"LONG-SAUT" CABLE AND PIPE CLAMPS



Used for attaching lead cable and parallel runs of bridge wire in interior block distribution.

This form of telephone construction is now being employed in all modern telephone plants.

"Long-Saut" Clamps are made to conform to every diameter of cable and may be used with or without bridge rings, as conditions require. Attached with Diamond Screw Anchors to brick, stone or concrete or with wood screws to wooden structures.

EMPIRE CONDUIT RODS

Patented No. 911,854, Feb. 9, 1909.



With or without Wheels

Made of best quality Hickory with quick-acting Automatic Couplings.

DIAMOND "RAPID FIRE" DRILL



Reduces cost of drilling hole in brick, stone and concrete. Strikes eight sharp blows with each turn of the crank. Points are interchangeable for all sizes of holes.



DOEHLER DIE-CASTING CO.

BROOKLYN, N. Y. TOLEDO, OHIO

Producers of Die-Castings in Aluminum and White Metal Alloys. Babbitt Lined Bronze Bearings

DOEHLER DIE-CASTINGS

That the economical advantages derived from the use of Doehler Die-Castings in place of machined parts are manifold is evidenced from their general adoption by the representative manufacturers of various metal products.

Manufacturers of Automobile Parts in particular have recognized the immense savings their use affords; and the phenomenal reductions in the price of automobiles in the last few years is in no small measure attributable to the extensive use of die-castings in their construction.

Cast from steel moulds or dies, which are built to an accuracy of .001, castings produced are uniformly accurate in most intricate details—making for a perfect interchangeability of parts—are sharp in outline, smooth in finish and in but rare and exceptional cases are ready for assembling without any further need for machining.



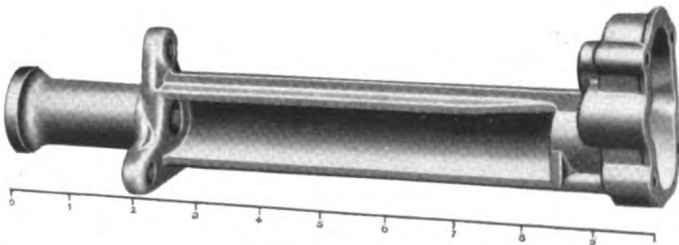
**Aluminum Die-Cast
Motorcycle Carburetor**

ALUMINUM

"Doehler" Aluminum Die-Castings have been developed to a high state of efficiency; they are cast from No. 12 metal which produces a casting that is tough, durable and has an excellent finish. Because of their unusually efficient combination of strength with light weight in addition to those qualities possessed by our white metal product, they are extensively replacing the use of machined parts.

WHITE METAL

"Doehler" Die-Castings in White Metal are adapted to the production of parts where utmost precision is essential, but where great strength is not required. When necessary, however, they may be re-enforced with brass or steel inserts to withstand additional strain at a given point.



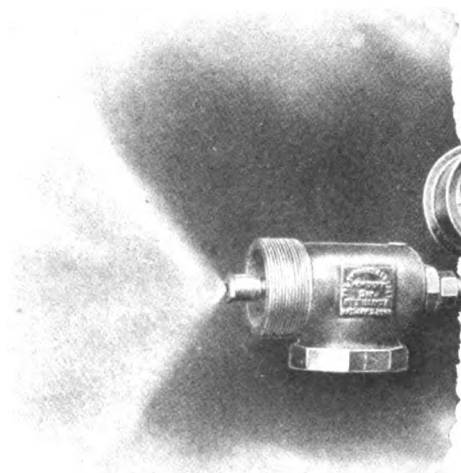
Die-Cast Oil Pump

THE ANTHONY COMPANY

138 WEST AVENUE, LONG ISLAND CITY, N. Y.

Liquid Fuel Engineers

Oil
Is the
Fuel
of the
Future



Consult
Us

264

Mechanical Atomization—A Perfect Mist of Oil

ANTHONY NEBULYTE OIL BURNERS

Low and High Pressure Designs to Suit Every Requirement.
A Trial Will Prove Their Unequalled Operating Characteristics.

ANTHONY OIL CRUCIBLE FURNACES

Large Output, Low Operating Cost, Long Crucible Life, Durable Linings.
Soft Flame, Small Shrinkage, Non-oxidized Metal.

ANTHONY OIL RIVET FURNACES

Compact, Portable, Economical, the Equal of Four Coal Forges.

ANTHONY OIL BURNING EQUIPMENT

For Annealing, Tempering, Hardening, Forging, Melting—All Purposes.
Designs Furnished at Reasonable Cost.

ANTHONY OIL BURNING SYSTEMS

For Industrial Heating Processes. For House Heating Uses.

ANTHONY NEBULYTE OIL SPRAYS

For Water Gas Machines.
Perfect Atomization, Positive Control, Uniform Distribution of Oil.

ANTHONY NEBULYTE SPRAYS of definite capacity and throw can be utilized to advantage for many purposes—cooling, aerating, atomizing, gasifying, mixing, distributing liquids over large areas, etc.

W. N. BEST, INC.

11 BROADWAY, NEW YORK

Engineers in Caloric: Liquid Fuel Equipment; Furnaces for Heating, Melting and Heat Treatment of Metals. High Pressure, Low Pressure, Volume Air, Air Carburetting and Mechanical Burners of All Sizes

"BEST" LIQUID FUEL FURNACES AND EQUIPMENT

Twenty-seven Years' Experience in Handling Liquid Fuel. All Installations Guaranteed.

Designs for changing coal-fired furnaces to oil-fired, for the remodeling of existing oil-fired furnaces, and the construction of all forms of furnaces for heating and heat treatment of metals.

If your present liquid fuel equipment is not in every way satisfactory, it can be remodeled to give perfect results. We guarantee entire satisfaction.

To secure 100% economy and 100% efficiency use W. N. Best Oil and Tar Burners for Annealing, Case Hardening, Tempering, Forging, Heat Treating, etc.

W. N. Best High Pressure Burner—Unmounted

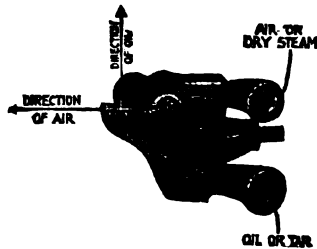
1. Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally, which prevents clogging or carbonizing, the burner always being kept clean.

2. By releasing the set screw in yoke and raising the lip any obstruction that might find its way through the air line can be blown out.

3. Air or dry steam from 15 pounds up can be used to atomize the oil.

4. The burner being in form of a syphon requires but very low oil pressure.

5. Burners can be fitted to throw either a long, narrow flame or a fan-shaped flame 9 feet wide, thus doing away with the necessity of using more than one burner in any fire-box or furnace that is 9 feet or less in width.



W. N. Best Oil Regulating Cock

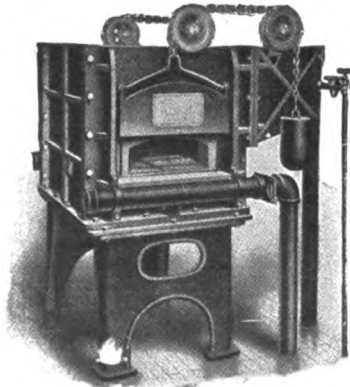
This regulating cock is provided with a V-shaped, knife-edged opening in the plug, which not only has a shearing action on heavy liquid fuels, but enables the operator to secure the finest possible adjustment.

When a furnace is working continuously on one class of work this cock can be set by the adjusting screw so that when the burner is stopped, it can be returned to the same adjustment when again started.

Class "D" Forge Furnace

Designed especially for drop forge work, but can be used for a wide range of heating, welding, tempering, etc. By placing a muffle in the charging space makes an ideal muffle furnace. Made with one or two charging openings.

The consuming fuel unites with the air necessary for perfect combustion in the combustion chamber before it reaches the charging space of the furnace—there is therefore no oxidation of the metal while being heated. The combustion chamber and arch are of such form and proportions that the flame and heat reverberate perfectly upon the charging space of the furnace.



GILBERT & BARKER MFG. CO.

Established 1885

SPRINGFIELD, MASS.

NEW YORK, 26 Broadway

Designers and Manufacturers of Fuel-Oil Burning Appliances, Fuel-Gas Machinery, Furnaces, Etc.

Fifty years' practical experience, combined with a thorough knowledge of fuels and combustion, enters into the designing and building of Gilbert & Barker Furnaces. Our furnaces are convenient for the operator, from whom they require little attention—giving a reliable and uniform heat throughout—and burning the fuel in the smallest possible space with complete combustion—they economize in time, labor, up-keep and fuel.

SEMI-MUFFLE FURNACES

For Case Hardening, Annealing, Carbonizing, Heat Treating, General Hardening and Heating Work.

(Oil or Gas Fuel.)

The Gilbert & Barker Semi-Muffle Furnaces are designed for and accomplish the most exacting work. Complete combustion of the fuel takes place beneath the floor of the heating chamber. The hot gases then pass to the heating chamber through suitable opening so placed that the heat is evenly distributed without a variation of one degree, and the perfect regulation of the flame makes oxidation and overheating impossible. Provision is made for a pyrometer by which the exact degree of heat can be accurately measured. No flue or chimney is required with this type of furnace.



Semi-Muffle Heat-Treating Furnace

GAS FURNACES

Our line includes End-Heating Furnaces, Forging and Welding Furnaces, Semi-Muffle Furnaces, Muffle Furnaces, Round, Rectangular and Double Pot Furnaces for hardening with lead and cyanide, Round and Rectangular Pot Furnaces for tempering and bluing, Crucible Furnaces, Bench Forges, and Soldering Furnaces.

BURNING FUEL OIL UNDER LOW PRESSURE

Under the Gilbert & Barker Process, oil is burned with a clean, clear fire, and with complete combustion.

For hardening, tempering, case hardening, melting, annealing, heating, singeing plates, and all sorts of work requiring a clean, even heat, oil has proved an economical fuel.

The apparatus consists of a specially constructed rotary oil pump, a storage tank, the burners and necessary piping. The oil is brought to the furnace under pressure and enters the furnace in the form of a spray. By our method of applying the burners to a furnace, free air is drawn in around the burner sufficient for complete combustion.

air compressor, an
The oil is brought



We shall be pleased to furnish complete information on the equipment of complete heat treating departments from storage tank to burner, and furnaces.

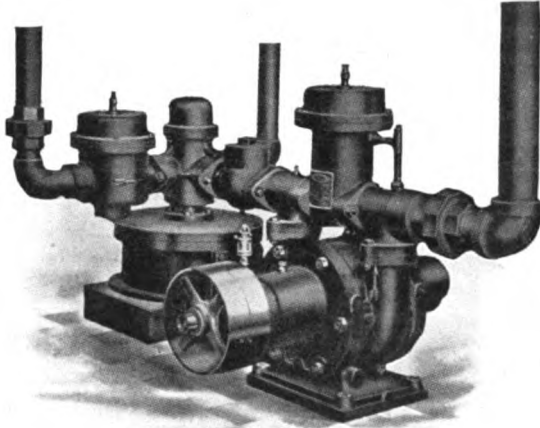


TRADE MARK

SELAS COMPANY

521 WEST 23RD ST., NEW YORK

Manufacturers of Apparatus for Gas Fuel Economy



THE SELAS APPARATUS

This apparatus mechanically mixes gas and air in definite, predetermined quantities and, at the same time, distributes the mixture through service under pressure.

It adds greatly to the well-understood advantages of gas as fuel and, in comparison with other methods of gas treatment, shows an actual, guaranteed saving of from twenty to forty percent.

Among the more important industrial fields in which the **Selas System** can be most efficiently employed are the following:

Annealing Ovens of All Kinds.
Auto-Radiator-Making.
Bakery Ovens.
Cable- and Fuse-Making.
Case Hardening.
Chain Welding.
Collar Factories.
Continuous Carbonizing.
Die Hardening.
Drying Ovens.
Electric Lamp Manufacturing.
Enameling Ovens.
Furnaces.
Gasoline-Tank-Making.
Heating Ovens.
Heat Treatment for Steel.
Heating for Coppersmiths
and Allied Industries.

Heating for Drop Forging.
Laundry Heating for All
Purposes.
Lacquering Ovens.
Melting of Metals and Alloys
in Stand and Tilting Furnaces.
Muffles.
Railroad Shops.
Steel-Tire Expanding.
Hardening and Tempering.
Tin-Plate and Can Manufacturing.
Tube, Rod and Wire Heating,
for Annealing, Bending,
Brazing, Welding, Etc.
Wire Drawing.
Blow-Pipes and Torches for
All Purposes.

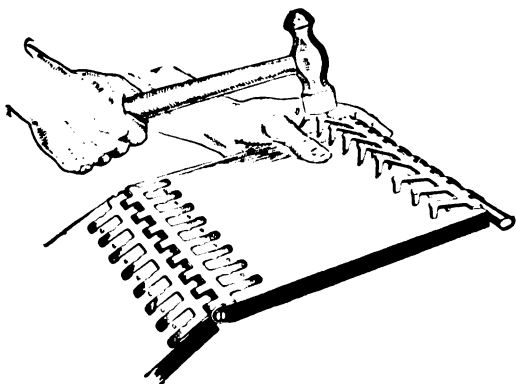
A staff of experienced engineers is constantly retained by the Company for the purpose of advising with those interested in more effective and economical fuel, to investigate conditions and submit estimates as to cost of installation.

Those interested are invited to write for full particulars and a list of well-known manufacturers who have adopted the **Selas System**.

FLEXIBLE STEEL LACING CO.

522 So. CLINTON ST., CHICAGO, ILL.

Manufacturers of Steel Belt Lacing and Lamp Guards



"Just A Hammer to Apply It"

"ALLIGATOR" STEEL BELT LACING

**Saves Time
Saves Labor**

The connecting bar between prongs is indented on the under side to allow it to be broken into required lengths and the use of a single section on any width of belt up to 12 inch. Each indentation separates a full staple which retains its efficiency.

Equip with ALLIGATOR—Now. The hinge joint is smooth on both sides alike, flexible and of extreme strength.

Gives lasting service on leather, cotton, rubber, balata or any width or thickness of machinery belting.

No delay to machine or operative, the joint made on the spot in a few minutes time.

"FLEXCO-LOK" GUARD

For Incandescent Lamps

Prevents—Lamp breakage and reduces fire hazard.

Protects—From theft.

Tested mechanical principles applied in a new manner.

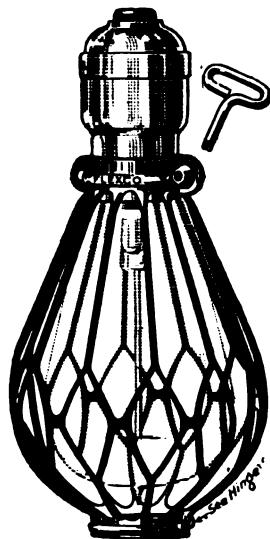
Made from steel well coated with tin and is light and strong. The hinge shells close with special design key screws to a rigid grasp on the socket.

Guard lasts long, costs less than one lamp, will save you buying many lamps.

Both "Alligator" Steel Belt Lacing and "Flexco-lok" Guard reduce maintenance costs.



Catalog will be gladly sent by return mail.



THE EDWARDS MANUFACTURING CO.

Incorporated 1901

306-336 EGGLESTON AVE., CINCINNATI, OHIO

Consulting Engineer & Patentee, LESTER G. WILSON, Mem. A. S. M. E.

BRANCH OFFICES AND WAREHOUSES

NEW YORK, N. Y., 81-83 Fulton Street
PHILADELPHIA, PA., 1414 Land Title Bldg.
BALTIMORE, MD., 7 Clay Street

PITTSBURGH, PA., Oliver Bldg.
SAN FRANCISCO, CAL., 315-319 Monadnock Bldg.
DALLAS, TEXAS, 1635-37-39 Pacific Ave.

Manufacturers of Sheet Metal Building Material

EDWARDS ROLLING STEEL DOORS AND SHUTTERS

Rolling Steel Doors have been designed by this Company's engineer, and successfully constructed for doorways of all sizes up to 40 feet in width, and for openings over 100 feet in height.

Rolling Shutters have been designed for windows and skylights. This Company is prepared to manufacture the combination complete, and with wire glass if desired. The rolling shutters are often operated in groups and sometimes by electric motors.



Section of Interlocking Slat

Types: Edwards Interlocking Slat Style is constructed of special cold rolled strip steel 22 to 14 gauge. *Bright or Galvanized.* Spring balanced. Handle or chain operation.

This section of slat gives great resistance to wind pressure. It was purchased by the U. S. Government for many buildings at the Panama Canal.

Edwards Corrugated Style is constructed of the best sheet steel procurable for this purpose. *Black or Galvanized.* Spring balanced. Handle or chain operation.

Our sheets have a special shape of corrugation and are fastened together without rivets.

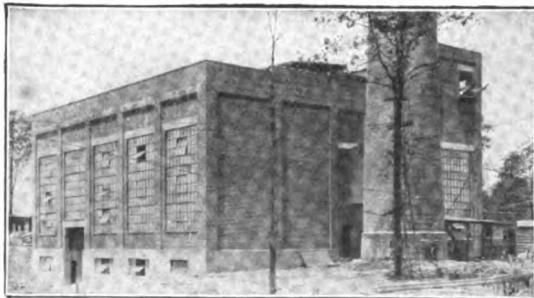


Section of Corrugated Sheet

Special Drawings: This organization will gladly prepare details and specifications for *all* types of doors and shutters, and so assist owner, architect or engineer to select the best and most economical installation.

Uses: Specify Edwards Rolling Doors and Shutters for:

- R. R. Shops
- R. R. Roundhouses
- R. R. Freight Sheds
- Express Buildings
- Steamship Docks
- Grain Elevators
- Telephone Exchanges
- Jails
- Banks
- Libraries
- Armories
- Gun Sheds
- Post Offices
- Garages
- Car Houses
- Warehouses
- Factories
- Elevators
- Craneways
- Power Plants
- Boiler Fronts
- Transformers
- Subways
- Store Fronts
- Stairways, etc.
- Residences during closed seasons



B. & O. R. R. Power House Equipped with Edwards Rolling Doors

Federal, County and Municipal Buildings
Office Buildings, Rear and Court Windows
Dampers for Heating and Ventilating Systems
Rolling Partitions for Churches and Schools
Cotton Mills, Compresses and Warehouses

The benefit of forty-four years' experience is placed by our Engineering Department at your disposal.

Ask for catalogs and drawings.

THE HASTINGS PAVEMENT CO.

EXECUTIVE OFFICES: 25 BROAD STREET, NEW YORK

WORKS: HASTINGS-ON-HUDSON, N. Y.

Manufacturers of Compressed Asphalt Paving Blocks and Tiles

ASPHALT PAVING BLOCKS

The logical material for the wearing surface of streets and roads, and of piers, warehouses, loading platforms, bridges, factory floors, driveways, courtyards, etc. Manufactured at a permanent plant; shipped in block form ready to lay; and always obtainable in any quantity for extension or repairs.

Composition and Size.—A properly proportioned mixture of natural asphalt, crushed trap rock and limestone dust is heated to 300 degrees Fahr., and shaped into uniform blocks under a pressure of 6000 pounds per square inch. The blocks are 5 inches wide, 12 inches long, and 2, 2½ and 3 inches deep. Specific gravity, 2.40.

Advantages.—Asphalt block pavements are pleasing in appearance, smooth, noiseless, dustless, sanitary because non-absorbent, and next to granite the most durable. Present a gritty, non-slippery, non-skiddable surface. Easily taken up and relaid. Reasonable cost. Not affected by extremes of temperatures. Made to suit any climate and traffic conditions.

Method of Laying.—Asphalt blocks are usually laid on a concrete foundation, upon which there is laid a cushion bed of cement mortar one-half inch thick, which is struck to a true and even surface. Upon this bed the blocks are immediately laid with close joints and uniform top surface, the joints being broken four inches. After being laid, the blocks are given a light coat of sharp, fine sand, well broomed into the joints. Traffic is permitted in four or five days.

ASPHALT TILES

A wearing surface especially designed for sidewalks, floors, etc., subject to foot traffic. These tiles are manufactured under the same successful methods used for the blocks. White limestone, used instead of trap rock, makes a more attractive surface. They are of great density, free from voids, non-absorbent, and extremely durable, as tile laid over twenty years ago are still in service, showing but little wear.

Method of Laying.—The large hexagonal and square tiles are usually laid on a foundation of six to eight inches of gravel and sand, with a curbing or border of square tiles set on edge. The small hexagonal tiles are laid on a foundation of three inches of concrete and one-half inch of mortar.



Asphalt Block Floors

The Modern Floor for Heavy Service

**CATALOGUE SECTION
PART V**

**Compressors, Fans, Blowers
Pumping and Hydraulic Machinery
Drying and Crushing Machinery
Engineering Miscellany**

271

Pages 272-310

INGERSOLL-RAND COMPANY

11 BROADWAY, NEW YORK, U. S. A.

Offices in All Principal Cities of the World


Builders of Air and Gas Compressors, Blowers, Pneumatic Hammers, Pneumatic Drills, Air Motor Hoists, Air Motors, Pneumatic Sand Rammers, Air Lift Pumps, Air Power Machinery of All Kinds

PRINCIPAL PRODUCTS

AIR COMPRESSORS	HOISTS, PORTABLE
AIR HOISTS	JACKHAMER DRILLS
AIR LIFT PUMPING SYSTEMS	PNEUMATIC TOOLS
AIR DRILLS	PORTABLE AIR COMPRESSORS
CAMERON PUMPS	RIVETING HAMMERS
CORE DRILLS	RIVET FORGES
CENTRIFUGAL PUMPS	ROCK DRILLS
CHANNELERS	STEAM PUMPS
CHIPPING HAMMERS	SAND RAMMERS
COAL PUNCHERS	STONE CHANNELERS
COAL SHEARING MACHINES	STONE TOOLS
CUPOLA BLOWERS	SUBMARINE DRILLS
DRILL STEEL	TIE PEELING OUTFITS
DRILL SHARPENERS	TIE TAMPING OUTFITS
DUPLEX PUMPS	TURBO BLOWERS
ELECTRIC-AIR ROCK DRILLS	TURBO COMPRESSORS
GAS COMPRESSORS	TURBO EXHAUSTERS
HAMMER DRILLS	VACUUM PUMPS
HOISTS, PNEUMATIC	WAGON DRILLS

272

Known by the Following Trade Names

"BUTTERFLY" ROCK DRILLS	"JACKHAMER" ROCK DRILLS
"CALYX" CORE DRILLS	"JACKSTOPER" ROCK DRILLS
"CAMERON" PUMPS	"LEYNER-INGERSOLL" ROCK DRILLS
"CROWN" PNEUMATIC TOOLS	"LEYNER" DRILL SHARPENERS
"ELECTRIC-AIR" ROCK DRILLS	"LEYNER" OIL FURNACES
"GASOLINE-AIR" ROCK DRILLS	"LITTLE DAVID" PNEUMATIC TOOLS
 DRILL STEEL	"LITTLE TUGGER" PORTABLE HOISTS
"IMPERIAL" PNEUMATIC TOOLS	"RADIALAXE" COAL CUTTERS
"IMPERIAL" AIR COMPRESSORS AND VACUUM PUMPS	
"INGERSOLL-ROGLER" AIR COMPRESSORS AND VACUUM PUMPS	

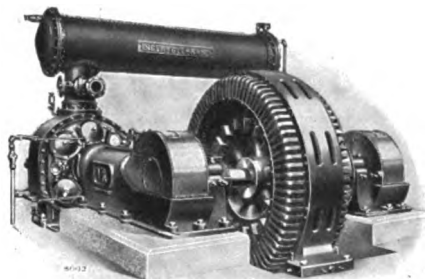
Catalogues covering any of these products furnished upon request.



41-M

INGERSOLL-RAND COMPANY

"INGERSOLL-ROGLER" AIR COMPRESSORS



"Ingersoll-Rogler" Class "PRE"

three- and multi-stage machines in capacities from 10 to 10,000 cubic feet of delivered air, pressures from vacuum to 1000 pounds gauge.

Bulletins 3024, 3026, 3028, 3030 and 3031.

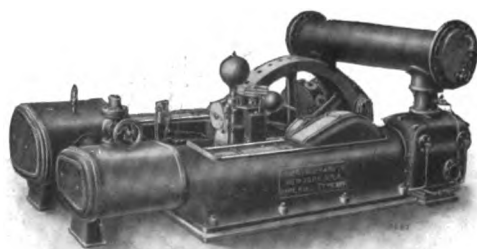
This type embodies among many important features the "Ingersoll-Rogler" air valve—simple in design, durable, noiseless and efficient in operation.

Straight line machines are built both stationary and portable, driven by belt, gear, noiseless chain, direct connected oil engine and balanced piston valve steam engine.

Duplex types are belt, rope, direct connected electric motor and Corliss steam engine driven.

The line includes single-, two-,

"IMPERIAL" AIR COMPRESSORS



"Imperial" Type "XPV"

The "Imperial" has been long and favorably known to the trade. Every refinement has been employed to make the "Imperial" a highly efficient and economical machine.

It is built in both power and steam driven types with duplex single- or two-stage air cylinders. Steam cylinders have balanced Piston Valve with automatic cut-off control.

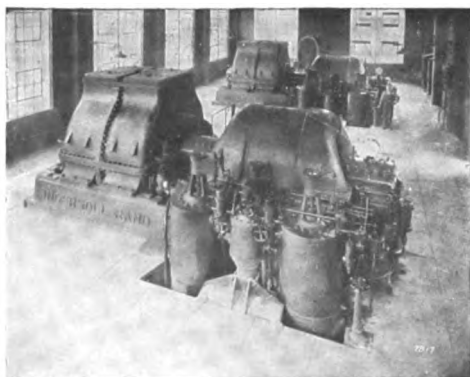
Capacities range from 200 to 3500 cubic feet—pressures from vacuum to 500 pounds.

Bulletins 3311, 3312 and 3033.

TURBO BLOWERS AND COMPRESSORS

The Company is prepared to build Turbo Blowers and Compressors for all industrial purposes, Turbo Gas Boosters for high pressure gas transmission, Cupola Blowers and Gas Exhausters.

Full information upon request.



Two 55,000 Cu. Ft. Turbo Blowers
Tennessee Coal Iron and R. R. Co., Ensley, Ala.

THE GARDNER GOVERNOR CO.

QUINCY, ILLINOIS, U. S. A.

BRANCH OFFICES

NEW YORK CITY
302 Singer Bldg.

PHILADELPHIA
54 N. 6th St.

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1317 Fisher Bldg.

LOS ANGELES
120 E. 3rd Street

RIX COMPRESSED AIR & DRILL CO.

SAN FRANCISCO
505 Howard Street

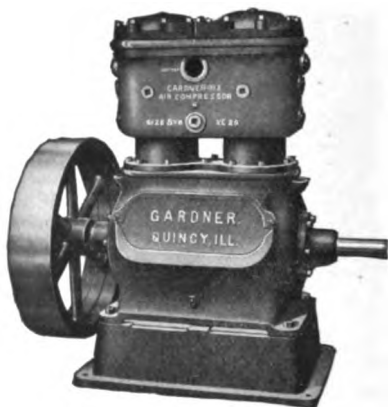
Builders of Duplex Steam and Power Pumps; Vertical and Horizontal Air Compressors; Engine Governors and Steam and Oil Separators

GARDNER POWER PUMPS AND AIR COMPRESSORS



CLASS "PMA" The Gardner Packed Piston Power Pump With Double Reduction Gear and Motor Attached on Top of Frame

Makes a very desirable unit, compact, requiring small floor space, and dispensing with the necessity of the expensive base plate. This is our standard method of motor connection where the size of motor permits of it being mounted on top.



Duplex High Speed Vertical Compressor.
Made in Sizes 42 ft. to 140 ft. Capacity



Air Cooled Enclosed Splash Type Compressor
Capacities to 21 ft.



Straight Line Horizontal Steam Driven Compressor
Capacities up to 1000 ft.

THE NORWALK IRON WORKS CO.

SO. NORWALK, CONN.

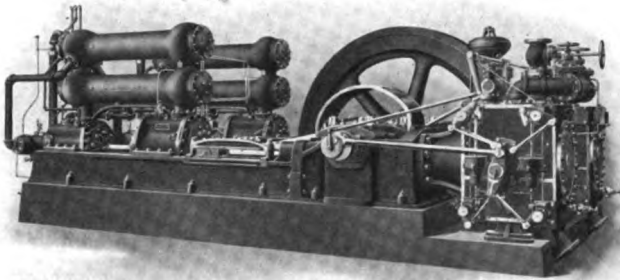
Builders of Air and Gas Compressors for All Classes of Service

NORWALK AIR AND GAS COMPRESSORS

Single and Multi-stage Compressors, steam, belt, or motor driven.

A standard line of Single and Two-stage Compressors for general shop use.

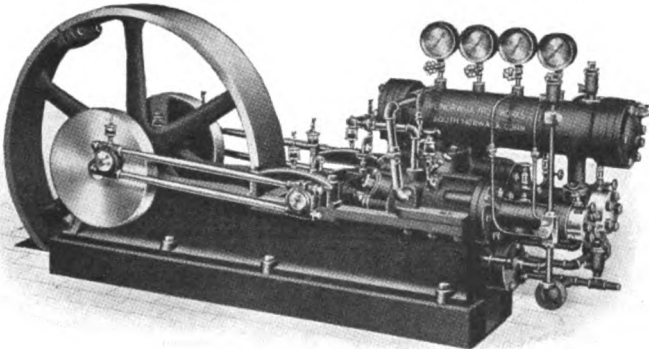
Automatic Proportional Unloaders, which regulate the air delivery to suit the demand.



**Three-stage, TWIN-DUPLEX Compressor with Simple Corliss Steam Cylinders,
Suitable for Compressing Air or Gas up to 2000 Lbs. Pressure**

We build a standard line of Three- and Four-stage Compressors, steam, belt, or motor driven, for compressing air or any of the commercial gases up to 7500 pounds per square inch.

The cut below shows a small Four-stage Compressor as built for Oxygen or Hydrogen to 5000 lbs. This type is extensively used for Liquefying Air, etc.



If you have any special compressing problems, submit them to us. Our long experience in this field enables us to meet the most difficult conditions.

Catalogs and full information on request.

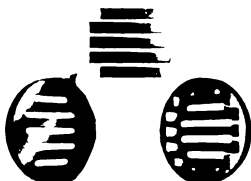
WORTHINGTON PUMP AND MACHINERY CORPORATION

115 BROADWAY, NEW YORK

Laidlaw Works: Cincinnati, Ohio

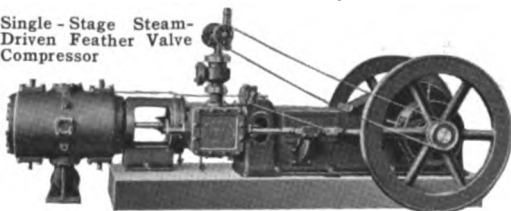
Branch Offices in All Principal Cities

Laidlaw Feather Valve Air Compressors, Vacuum Pumps, High Duty Pumping Engines



Parts of
Laidlaw Feather Valve

Single-Stage Steam-
Driven Feather Valve
Compressor



FEATHER VALVE AIR COMPRESSORS

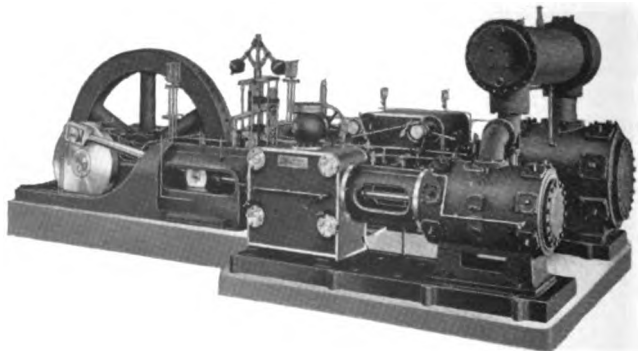
The Laidlaw Dunn Gordon Plant now uses the Laidlaw Feather Valve exclusively on all compressors and for every possible condition of service.

But little more than a year has elapsed since the announcement of the Laidlaw Feather Valve for air and gas compressors. During this time, more than 600 Feather Valve compressors have been built and installed. These machines vary in capacity from 200 cu. ft. per minute to 6000 cu. ft. per minute and comprise a total capacity of

more than 485,000 cu. ft. per minute and represent a total Horse Power of not less than 45,000.

The immediate acceptance of so radical a change in air compressor valve design, implied by this large number of installations, can only be explained by the wonderful simplicity and self-evident superiority of the Laidlaw Feather Valve.

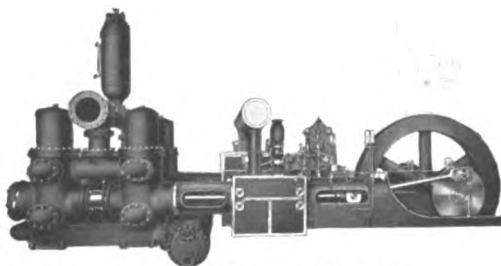
Corliss
Feather Valve
Compressor



HIGH DUTY PUMPING ENGINES.

One million to twelve million gallons capacity. We are replacing direct acting plants of the older type, in large numbers, with high duty installations, operating on one-third to one-half of the previous fuel expenditure.

Our business policy is based on the effort to so completely satisfy a client, as to insure our receiving his next order.



L 248.8

High Duty Pumping Engine

THE VILTER MANUFACTURING CO.

1194-1196 CLINTON ST., MILWAUKEE, WIS., U. S. A.

Builders of Ice Making and Refrigerating Machinery, Corliss Engines, Ammonia Fittings, Special Machinery, Etc.

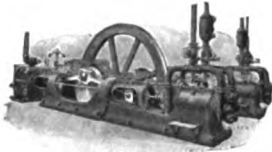


Fig. 1



Fig. 2

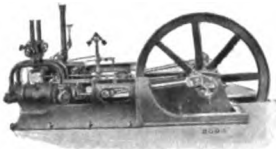


Fig. 3

HEAVY DUTY AMMONIA COMPRESSORS

Fig. 1 illustrates a duplex unit with horizontal double acting ammonia compressors, direct connected to cross compound Corliss Engine. Compressors equipped with multiple valve heads, giving maximum area. The duplex type is built in sizes from 125 to 750 tons' daily refrigerating capacity.

Fig. 2. A simple, heavy duty unit, direct connected to tandem compound Corliss Engine. The design and construction is such as will insure satisfactory service and freedom from trouble. Built in sizes from 50 to 375 tons' daily refrigerating capacity.

Fig. 3. This unit is of the same design as the above, being, however, direct connected to a simple, heavy duty Corliss Engine. The base of the frame extends from the pillow block around the solid crank pit. Built in sizes from 40 to 375 tons' daily refrigerating capacity.

STANDARD AMMONIA COMPRESSORS

Fig. 4. The Rolling Mill Type Corliss Engine is of massive construction throughout, the pillow block and guide being made in one casting, securing great strength and rigidity. The lines of this type frame are of particularly graceful design and are of great strength and stiffness.

Fig. 5. The belt driven machines are furnished in both the standard and heavy duty styles, either single or duplex. These units may be driven by electric motor, gas or oil engines, etc. Single units built in sizes from 6 to 175 tons' daily refrigerating capacity, duplex units in sizes from 12 to 750 tons' daily refrigerating capacity.

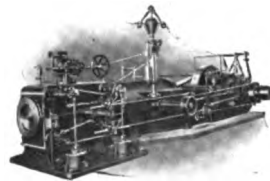


Fig. 4

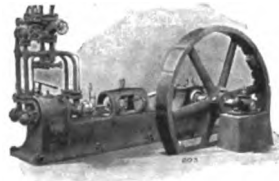


Fig. 5

SMALL CAPACITY VERTICAL AMMONIA COMPRESSORS

Fig. 6. A small, single acting compressor, especially designed for users of comparatively small quantities of refrigeration. The design unites the base, main bearing and crank case in a single massive casting, cylindrical sections being used throughout, giving simplicity, symmetry and strength. Single units, either belt or steam driven, made in sizes from 1.11 to 12.6 tons' daily refrigerating capacity. Duplex units, belt driven only, made in sizes from 2.22 to 25 tons' daily refrigerating capacity.



Fig. 6



LITERATURE

Bulletins, catalogs and full data regarding our products mailed on request.

NATIONAL BRAKE & ELECTRIC CO.

WORKS AT MILWAUKEE, WIS.

DISTRICT SALES OFFICES:

NEW YORK
165 Broadway

CHICAGO, ILL.
827 Railway Exchange

ST. LOUIS, MO.
Boatmen's Bank Bldg.

PITTSBURGH, PA.
9th and Penn Ave.

Manufacturers of National Air Compressors, Both Stationary and Portable, Motor, Gas, and Belt Driven

The National Brake & Electric Co. are the pioneers in the designing and building of motor driven air compressor units. Its products are designed by specialists of extended experience in the art and are manufactured in shops especially equipped for the production of motor driven air compressors.

NATIONAL STATIONARY COMPRESSORS

Primarily these compressors were designed for use in connection with air brake equipments in electric cars, a service requiring an unusual degree of efficiency, reliability, compactness, ease of access and quiet operation. They have been carefully developed to their present state of perfection and embrace advanced features of construction.



Type "H"—D. C. Compressor

TYPE "H"—D. C. MOTOR DRIVEN

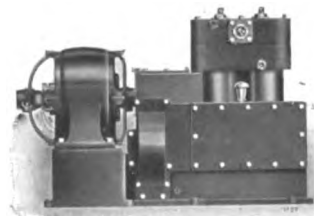
These compressors with capacities ranging from 11 to 50 cubic feet of free air per minute are built for pressures not exceeding 100 pounds unless otherwise specified. They are equipped with D. C. motors of the enclosed type and are built for intermittent service, with limited periods of work and rest.



Type "L"—D. C. Compressor

TYPE "L"—D. C. MOTOR DRIVEN

When conditions necessitate a continuous supply of compressed air in small quantities, National Type "L" Compressors will be found singularly adapted to such requirements. This type of compressor is built in capacities ranging from 11 to 40 cubic feet of free air per minute and designed for pressures not exceeding 100 pounds unless otherwise specified.



Type "E"—D. C. Compressor

TYPE "E"—D. C. MOTOR DRIVEN

These compressors are built for continuous service in capacities of 50 to 100 cubic feet of free air per minute and for pressures not exceeding 100 pounds, unless otherwise specified.

TYPES "H," "L" AND "E"

A. C. Motor Driven—1, 2 and 3 phase

Standard polyphase induction motors require that the compressor be unloaded at the time of starting and all types H, L & E induction motor driven compressors (2 and 3 phase) are equipped with a manual unloader, unless otherwise specified. When complete automatic control is desired, polyphase alternating-current motor driven compressors can be furnished with National Automatic Governor for closing and opening the motor circuits when the air pressure has reached a predetermined minimum or maximum, together with a National Centrifugal type Unloader, which automatically unloads the compressor at the time of shutting down and keeps it in an unloaded state until the motor has again been started and attained nearly its normal full speed.

Ask for Catalog F400



Type "H"—A. C. Compressor

NATIONAL BRAKE & ELECTRIC CO.

NATIONAL STATIONARY COMPRESSORS (Continued)

TYPE "3VS"—A. C. AND D. C. MOTOR DRIVEN

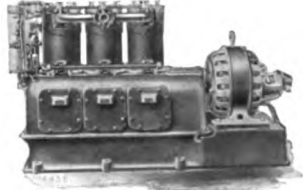
The National Type "3VS" Air Compressor has been designed to meet the constantly increasing demand for a self-contained electrically driven air compressor unit.

The air compressors of this type have completely water-jacketed cylinders and cylinder heads, are designed for continuous service, and are built in standard capacities of 50, 100, 150, 225 and 300 cubic feet of free air per minute.

Type "3VS" motor driven compressors are equipped with complete automatic controlling devices, which permit the starting of the direct current compressors with not to exceed one-half full load current, and the alternating current compressors with not to exceed full load current. They are also equipped with automatic unloader and automatically controlled water valves. National combined automatic controlling devices for motor driven compressors are absolutely reliable and efficient.

TYPE "3VD"—A. C. AND D. C. MOTOR DRIVEN

This compressor is designed for continuous service and is built in one size only, having a piston displacement of 550 cu. ft. per minute, and is equipped with the same design of combined automatic controlling devices as the "3VS," except being arranged for higher duty.



Type "3VS"—A. C. Compressor



Type "3VD"—A. C. Compressor

NATIONAL STATIONARY COMPOUND AIR COMPRESSORS

TYPE "Q-L" AND "Q-E"—A. C. AND D. C. MOTOR DRIVEN

National Type "Q" Compressors, with capacities ranging from 7 to 70 cubic feet of free air per minute, are intended for service where conditions necessitate the constant delivery of air at high pressures, within the maximum limits, however, of either 200 or 350 pounds. In the latter instance, the compressor, in comparison with that rated at 200 pounds pressure, will have reduced displacement capacity to offset increased pressure.



Type "QL"—A. C. Compressor

NATIONAL PORTABLE AIR COMPRESSORS

National Portable Air Compressor Outfits are ideally adapted for use in mercantile establishments, mines, quarries, manufacturing plants, and in construction work, where the available floor space is limited, or the nature of the work requires that a supply of compressed air be delivered in different places and under constantly changing conditions.

These portable outfits can be equipped with the same type of motor compressor and controlled in the same manner as any of the National Stationary Compressors previously described.



Type "H" Portable Compressor

NATIONAL GAS DRIVEN AIR COMPRESSORS

With the increased adoption of gas motors there has been a constantly increasing demand for "National Air Compressors" driven by gas motors. These self-contained units of power will be found most efficient and economical for contracting and construction work, especially where electric power or steam is not available. The same superior features of design that characterize National Type "E" and "3VS" motor driven air compressors are embodied in National Type "E" and "3VS" Gas Driven Air Compressors.

Ask for Catalogs F400 and F401



Type "E" Gas Driven Portable Compressor

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN

Manufacturers of Heating, Ventilating, Cooling, Purifying, Humidifying, Drying, Mechanical Draft and Blast Equipment; Vertical Self-Oiling Steam Engines, Steam Traps; Fans and Blowers for All Purposes



Fig. 1

"Sirocco"
TRADE MARK

SYSTEM OF PURIFYING, COOLING AND HUMIDIFYING

For Purifying and Humidifying air in Schools, other Public and Semi-Public Buildings.

For Humidifying and Cooling air in Textile Mills, Macaroni Drying Plants, Printing Houses, and other industrial plants.

For Dehumidifying and Cooling in Candy Factories, Bakeries, Photo Film Drying Rooms, Blast Furnaces, Electric Generators, etc.

Capacities from 3,500 C. F. M. to 350,000 C. F. M.

Write for "detail" information.

Fig. 1 shows "Sirocco" Air Purifier, Cooler and Humidifier.



Fig. 2

MULTI-BLADE FANS AND BLOWERS

For Heating, Ventilating and Cooling in Public, Office, Industrial and Educational Buildings.

For Drying and Mechanical Draft. Sirocco Multi-Blade Fans will handle more air consuming less power than the ordinary steel plate fan, having twice the wheel diameter.

Built with capacities of from 75 C. F. M. to 1,000,000 C. F. M.

Complete specifying information at your request.

Fig. 2 shows "Sirocco" Multi-Blade Fan for Pulley, Motor or Engine Drive.

Fig. 3 shows "Sirocco" Multi-Blade Fan Wheel.



Fig. 3

"ABC" EXHAUST FANS FOR EXHAUSTING AND CONVEYING SYSTEMS

Exhaust shavings, dust and refuse from wood-working plants.

Take away the dust from emery grinders, buffing and polishing wheels.

Remove smoke and gases from forge fires.

Exhaust the dust from cement plants, flour mills and similar plants.

Remove steam and vapor from vats and kettles in breweries, packing houses, textile and rubber factories.

Elevate and Convey cotton and wool in textile mills.

There is a size and type to meet any requirement.

Capacity tables and complete data sent upon request.

Fig. 4 shows Type "E" Fan for pulley drive. This and other types are furnished also with direct connected motors.



Fig. 4



Fig. 5

TYPE "P" SPECIAL STEEL PRESSURE BLOWERS FOR FURNACE AND CUPOLA SERVICE

For supplying draft to Oil and Gas Furnaces; Cupolas; Sintering, Smelting and Pulverized Coal Machines.

For blowing scale from dies in drop forge plants.

Bearings being on independent foundations precludes vibration in the housings. Built to discharge at any angle, against pressures from 1 to 24 ounces.

Ask for complete working data.

Fig. 5 shows Type "P" Special Steel Pressure Blower.

AMERICAN BLOWER CO.

BRANCH OFFICES

ATLANTA, BOSTON, CHICAGO, CLEVELAND, COLUMBUS, O., DALLAS, DENVER, DES MOINES, GRAND RAPIDS, MICH., INDIANAPOLIS, KANSAS CITY, LOS ANGELES, MINNEAPOLIS, NEW YORK, PHILADELPHIA, PITTSBURGH, ROCHESTER, SAN FRANCISCO, SALT LAKE CITY, SEATTLE, ST. LOUIS, with works at TROY, N. Y., and CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO.



"ABC" VERTICAL, SELF-OILING STEAM ENGINES

Type "A"—Single Cylinder—Engines develop up to 60 H. P. For school or other work where steam pressure is limited to 30 pounds—advocate Type "A" Low Pressure Engines, develop up to 40 H. P.

Type "E"—Double Cylinder—Engines develop up to 120 H. P. This engine is advantageous where more than 40 H. P. and fairly high rotative speed is required and only small space available.

Type "X"—Compound—Engines develop up to 120 H. P. This compound engine is a very conservative steam consumer for H. P. developed. Same space requirements as for Type "E."

Complete information on all types at your request.

Fig. 6 shows "ABC" Engine direct-connected to dynamo for generating electric current.

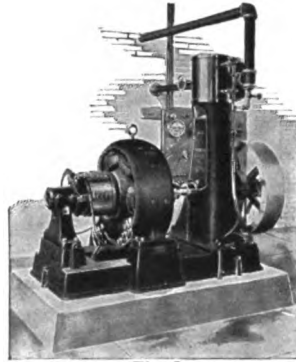


Fig. 6

"DETROIT" AUTOMATIC STEAM TRAP SYSTEMS

Return, Non-Return, Vacuum, Metering, Lifting and Combination.

For all steam systems under all pressures.

The hot condensation is returned direct to the boiler automatically—at the temperature at which it is condensed.

A few applications—Lumber Dry Kilns; Brick Tunnels; Vacuum Pans; Steam Cooking Kettles; Laundry, Veneer and Paper Machines (Heating Systems—Gravity Return—Vacuum); Vulcanizers; Hot Rolls, etc.

Any condensation handling problem can be economically solved by the use of "Detroit" Traps.

Let us send you full data.

Fig. 7 shows "Detroit" Automatic Return Trap.



Fig. 7

TYPE "V" UNIVERSAL BLOWERS AND EXHAUSTERS

Four angles of discharge right hand drive and four angles of discharge left hand drive can be made from one Type "V" Universal Fan (aside from various angular discharges). For all Blowing and Exhausting work requiring up to four ounces pressure. Built for either pulley or motor drive.

Write for latest Bulletin.

Fig. 8 shows Type "V" Bottom Horizontal, Right Hand Universal Fan. Pulley drive.



Fig. 8

"VENTURA" DISC VENTILATING FAN

For delivering large volumes of air at low pressure or against small resistances.

Low price—Small power consumption and inexpensive to install.

For Ventilating rooms and buildings—Ventura, motor driven, ventilating fans 650 C. F. M. to 17,500 C. F. M.

For ventilating small mines or at any mine where a disc fan can be used—engine or motor driven—from 12,000 C. F. M. to 100,000 C. F. M. resistance not to exceed 1" W. G.

Write for complete information.

Fig. 9 shows Ventura motor driven ventilating fan.



Fig. 9

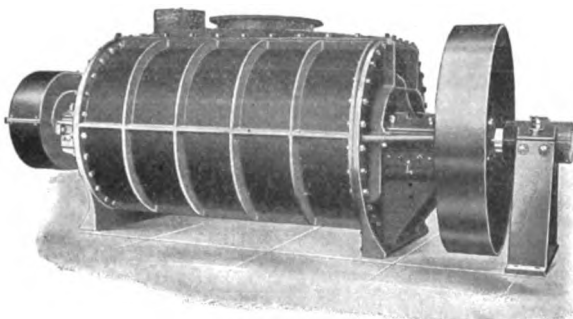
P. H. & F. M. ROOTS COMPANY

HOME OFFICE, CONNERSVILLE, IND.

NEW YORK OFFICE, 120-122 Liberty St.

CHICAGO OFFICE, 1245 Marquette Bldg.

Manufacturers of Rotary Positive Pressure Blowers, Gas Exhausters, Pumps, Flexible Rope Couplings



Foundry Blower with Pulley and Outboard Bearing



FOUNDRY BLOWERS

Used for Cupolas, Oil Furnaces and any Low Pressure Service.



Smelting Blower, Single Geared, Double Outboard Bearing with Double Acting Quick Opening Blast Gate

SMELTING BLOWERS

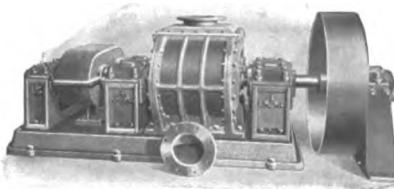
These Blowers of full length are nominally built for two pounds' pressure but they are capable of operating under two and one-half pounds. All bearings are quarter-box construction with removable shells to meet hard service, easy adjustment and quick renewal. Sizes range up to 400 foot machines.



High Pressure Blower

HIGH PRESSURE BLOWERS

This type of Blower is used for all high pressure service, pressures ranging from 4 to 10 pounds. This type of machine has proven very popular in flotation work.



Vacuum Pump with Pulley and Outboard Bearing 20 feet.

VACUUM PUMPS

These Pumps are used in service requiring vacuum of 24" or less. Where the Pump does not work against a head, we recommend bottom discharge, but for services requiring a discharge head, we furnish these Pumps with straight line impellers, which are capable of operating under heads up to

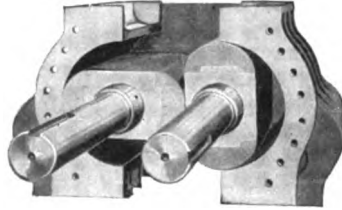
P. H. & F. M. ROOTS COMPANY



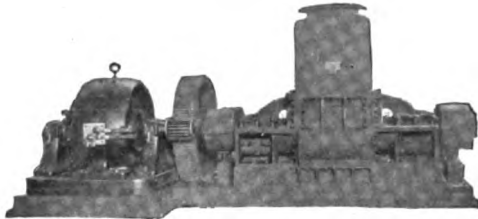
ROTARY WATER PUMPS

Briefly, the operation of the Pumps is as follows: The revolution of the shafts and impellers traps the water between the lobes and the case, delivers it to the discharge side, where the rolling together of the impellers on the center lines of the shaft prevents the return of the water.

These Pumps handle any liquid substance not containing grit, under any head from ten to two hundred feet, with an economy ranging from 75 per cent to 85 per cent of the power applied to the Pump shaft.



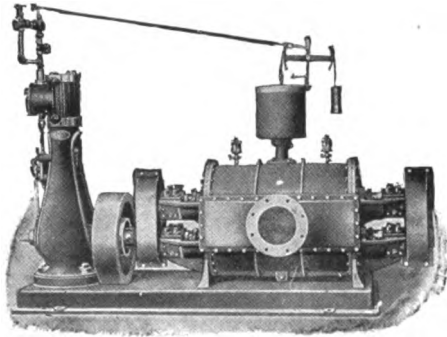
Interior Construction of Rotary Pump



Direct Connected Motor and Pump

GAS EXHAUSTERS

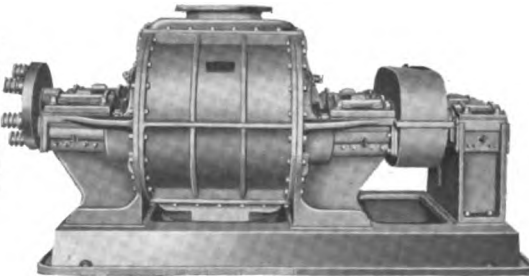
These Gas Exhausters are used for all foul gas service, and are usually furnished complete with Engine and Governor. We can furnish this type of machine direct connected to constant speed Motor, fluctuations in capacity being taken care of by an automatic by-pass control from float.



Gas Exhauster, Engine Drive, Float Governor

HIGH PRESSURE GAS PUMPS

These machines operate under heavy duty, being designed to handle gas under pressures of 10 pounds or less. They are largely used for high pressure distribution and by-product coke oven service.



High Pressure Gas Pump



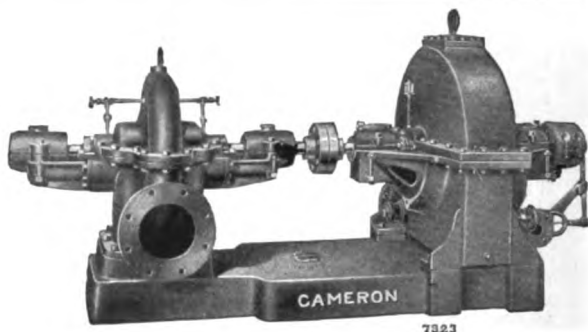
A. S. CAMERON STEAM PUMP WORKS

11 BROADWAY, NEW YORK

Offices in All Principal Cities of the World

Designers and Builders of Centrifugal and Triplex Electric Pumps; Simple and Compound, Piston and Plunger Simplex and Duplex Steam Pumps for All Classes of Service

CAMERON DOUBLE SUCTION VOLUTE PUMP

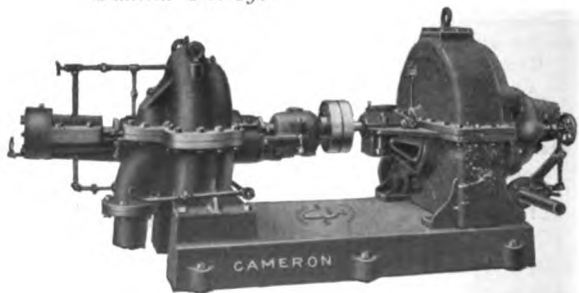


Cameron Centrifugal Pumps are the most modern in design, and are highly efficient and economical.

The Double Suction Volute Pump is especially adapted for general service. The casing is horizontally split, allowing quick, easy access to all working parts. The impeller is enclosed, and perfectly balanced. Built for capacities from 50 to 15000 G. P. M., for heads from 10 to 200 feet. Can be direct-connected to steam turbine or other forms of power drive.

Bulletin No. 150

CAMERON MULTI-STAGE TURBINE PUMP



The Cameron Multi-Stage Turbine Centrifugal Pump is simple and compact, strong and dependable. All parts accessible by means of the horizontally split casing.

This pump gives an exceptionally high efficiency over a wide range of capacity. The cost of upkeep is very low.

It is built in two, three and four stages for a wide variation of speed and capacities from 75 G. P. M. to 2500 G. P. M., against heads from 120 to 800 feet. The drive may be steam turbine or any available motive power.

Bulletin No. 151

Cameron Steam Pumps have fewer working parts than any other steam pump, and none exposed. Only four pieces in the Steam Mechanism. By merely removing the valve chest cover on the water end the whole interior of the valve chamber is plainly visible.

All the way through it is compactly and ruggedly constructed.

Built in many types and sizes for all classes of service.

Bulletin No. 104

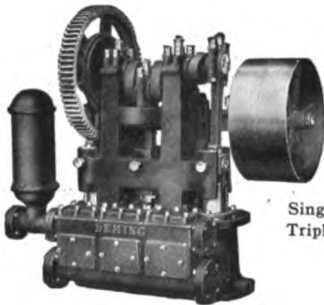
THE DEMING COMPANY

SALEM, OHIO, U. S. A.

NEW YORK OFFICE AND STOCK: 152 Chambers Street
Manufacturers of Hand and Power Pumps for All Uses

SINGLE AND DOUBLE ACTING TRIPLEX PUMPS ARTESIAN WELL PUMPS AND CYLINDERS

For Operation by Electric Motor, Gas or Gasoline Engine or Belt from Shaft



Single-Acting
Triplex Pumps

Fig. 50, Size 7x8 to 8 1/4 x 8

Made in sizes from 2x2 to 13x14; capacities of 7300 to 58,000 gallons per hour. For Water-works, Boiler Feeding, General Water Supply, etc.

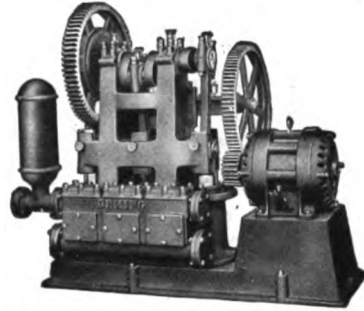


Fig. 50, Size 5 1/4 x 8 with Type "B" Drive



Fig. 70, 5x6, Portable Electric Mine Pump
Made in sizes from 3 1/2 x 4 to 8 1/2 x 8, with capacities of 1,800 gallons to 18,000 gallons per hour.



Fig. 62, 10-inch

Made in three strokes, 10, 16, and 24". For wells 300 ft. deep or less.



Fig. 53, Single-Acting Triplex Stuff Pump for 75 lbs. Pressure
For Handling Paper Stock and Thick Liquids. Made in sizes from 4x6 to 11x12.

Complete
192 Page
Power Pump
Catalogue
Mailed to
Engineers
on Application

Deming Triplex Power
Pumps Effect a
Savings from 30%
to 66% over Steam
Pumps.



Fig. 80, Deep Well Working Head with Differential Plunger
16" and 24" strokes. For wells 725 ft. deep or less.

EPPING-CARPENTER PUMP CO.

MAIN OFFICE AND FACTORY:

PITTSBURGH, PA.

NEW YORK OFFICE: 90 West St., New York

Sales Offices or Agencies in All Principal Cities

Pumps For Every Service

Single and Duplex Direct-Acting Pumps, with Simple, Compound or Triple Expansion Steam Ends.

Cross Compound Opposed Type Corliss and Meyer Gear Pumping Engines.

Volute and Multi-Stage Centrifugal Pumps with Belt Motor or Steam Turbine Drive.

High Efficiency Duplex Power Pumps with herringbone gears.

Jet and Surface Condensers, Accumulators weighted or steam loaded.

Our Pumps are fitted with Packed Piston Pattern, Outside Center Packed Pattern, or Outside End Packed Pot Valve Pattern Water Ends.

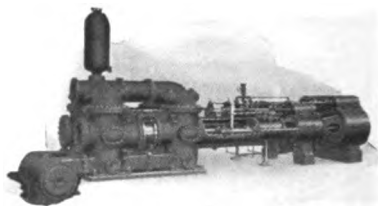
Duplex Direct-Acting Pumps under 6" stroke are fitted with Slide Valves. Pumps over 6" or longer stroke may be fitted with Slide Valve Steam End or with Balanced Piston Valve Steam End with Patented Outside Adjustable Valve Gear. The latter is strongly recommended for all conditions of service, but more particularly for superheated and high pressure steam. We guarantee our Balanced Piston Valves to operate under any degree of superheat.

Hydraulic Pumps are built with cast steel water ends for moderate pressures, and with forged steel water ends for higher pressures.

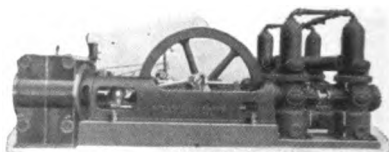
Power Pumps are built and designed to give the highest obtainable efficiency, and for all capacities and pressures.

Our line of pumps is exceptionally complete and we are in position to meet any requirements.

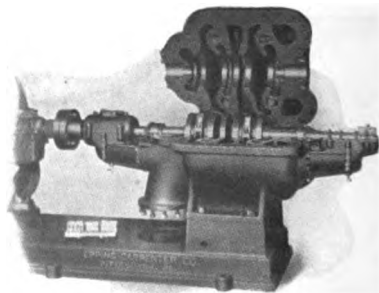
FIFTY YEARS IN BUSINESS



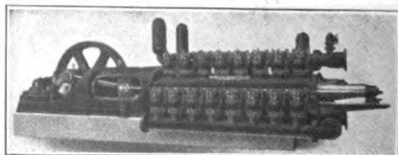
Triple Expansion Center Packed Pump



Cross Compound Corliss Pumping Engine



Multi-Stage Centrifugal Pump



Hydraulic Power Pump

13,000 PUMPS IN SERVICE

MANISTEE IRON WORKS CO.

MANISTEE, MICH.

Sole Manufacturers and licensees for the United States and Canada for the

Rees "Roturbo" Patent Pressure Chamber Pump, Rotary Jet Condenser, and Air Pump

REES RoTURBo ROTARY PUMPS



TRADE MARK

The special feature of the Rees RoTURBo Pump lies in the construction of the impeller, which, instead of being built with a flat disc runner with the main object of securing velocity of water in the expanding channels of the fixed casing, is designed in the form of a drum, or pressure chamber, the object aimed at being to secure a constant pressure inside of the revolving impeller equivalent to the pressure required. The impeller having this large capacity, the water inside, as it approaches the rim, becomes practically stationary, relative to the impeller—thus eliminating frictional losses and generating the pressure by centrifugal force.

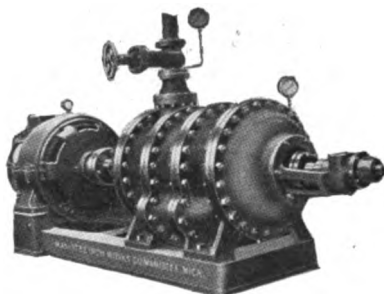
In the rim of the ranged a series of ing in a rearward di-blades have the effect tion of the pressure locity and owing to tion, the pressure in the drum is available for a turbine effect which increases with increased volumes of water flowing through the drum.



impeller there are ar-turbine blades point-rection and these of converting a por-in the drum into ve-their rearward direc-

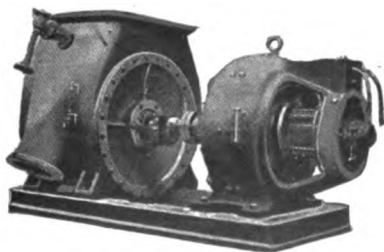
The result of this turbine effect is to transfer the power, which would otherwise be absorbed by the motor or other driving mechanism, to the rim of the impeller, and, consequently the power taken by the motor never exceeds that required at normal duty of the pump, and at low heads, the power taken by the motor actually decreases. Owing to this self-regulating feature of this type of pump, IT IS IMPOSSIBLE TO OVERLOAD THE MOTOR.

We invite your inquiries so that our Engineers can offer you our proposition, with full details, catalogues, and characteristic curves. We make pumps for all services, all sizes and stages, with any type of drive to suit your existing conditions.



Rees RoTURBo Multi-Stage Pump, capacity 1,000 gallons per minute, 570 ft. head 1140 R. P. M.

REES RoTURBo ROTARY JET CONDENSERS



Rees RoTURBo Rotary Jet Condenser

These can be driven by either Electric Motors, Steam Engines or Steam Turbines.

The vacuum attained is within a fraction of an inch of the theoretical possible. The condenser is extremely simple, having one Rotating Shaft and impeller only. There are no other moving parts whatever. The Rees RoTURBo Rotary Air Pump is on the same principle. Full details and quotations on application.

MORRIS MACHINE WORKS

BALDWINVILLE, N. Y.

Branch Offices in Principal Cities

Builders of Centrifugal Pumping Machinery, Hydraulic Dredges, Stationary and Marine Engines



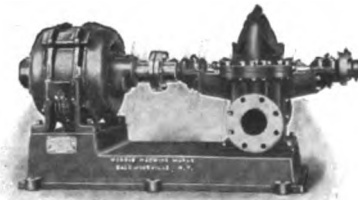
30" Side Suction Pump



Standard Double Suction Steam Pump

We build CENTRIFUGAL PUMPS for almost any service and of all types, including side suction and double suction, vertical or horizontal shaft. STAGE PUMPS for high heads. TWIN PUMPS for large capacities and high speeds. Or will design SPECIAL PUMPS to suit special conditions. As the oldest and largest firm in the country building exclusively this class of machinery, our experience of over fifty years has covered all services for which Centrifugal Pumps have been used.

MORRIS CENTRIFUGAL PUMPS are perfectly balanced, require small space and foundation; have high efficiency; are equally suitable for from small up to very large capacities, and can handle sand or solids with the water without injury. These pumps direct connected to reciprocating engines are suitable for moderate heads, or direct connected to electric motor or steam turbine (or belt driven) for high heads. For heads above 100 feet, pumps are preferably built in stages.



4" Horizontally Split Double Suction Motor Pump

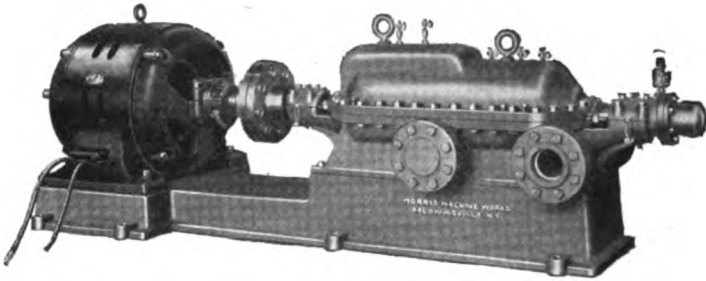
The Standard Horizontal Side Suction Pump (not illustrated) is the type most extensively used for all purposes and for general work is the best pump on the market. These pumps in iron construction are listed below. Specifications for pumps above 20-inch furnished on application.

MORRIS IMPROVED STANDARD IRON HORIZONTAL PUMP

No. Pump (Diameter Discharge Opening)	Size Pipe Flange on Suction, Inches	Economical Capacity, for Each Gallon per Minute	Horse-Power Required Pulley, Foot Head	Diameter and Face of Pulley, in Inches	Floor Space Required in Inches, without Primer	Shipping Weight without Primer, Lbs.	Shipping Weight with Primer, Lbs.
1	1 1/4	30	.025	4x 3 1/4	12x 7	85	....
1 1/2	2	70	.058	6x 6	17x 31	175	220
1 3/4	2	90	.075	7x 8	21x 32	260	305
2	3	120	.10	8x 8	23x 37	350	415
2 1/2	3	180	.15	8x 8	24x 38	360	430
3	4	260	.22	8x 8	25x 39	415	495
4	5	470	.30	10x10	29x 41	615	720
5	6	735	.45	12x12	34x 54	940	1075
6	8	1050	.59	15x12	37x 55	1180	1345
8	10	2000	1.00	20x12	45x 64	2065	2430
10	12	3000	1.52	24x12	51x 69	2610	2940
12	15	4200	2.00	30x14	63x 71	3615	....
15	18	7000	3.50	40x15	77x 80	8250	....
15*	18	7000	3.50	30x15	60x 68	3350	....
18	20	10000	4.50	40x16	93x103	9000	....
18*	20	10000	4.50	30x16	66x 72	5800	....
20	22	12000	5.00	36x20	73x 83	7000	....
24*	24	15000	5.50	48x36	94x137	10800	....

* Refers to Low-Lift Pumps, which are recommended for heads up to 40 feet.

MORRIS MACHINE WORKS



4" 6-Stage Boiler Feed Pump

When making inquiries for pumps, full information should be given—that is, quantity of water desired, head, including friction (or give actual elevation and length of suction and discharge piping), type of pump desired, how driven—whether belt, steam engine, electric motor (give electric current characteristics), arrangement of suction and discharge openings desired, whether right hand or left hand, etc.

DREDGING PUMPS

MORRIS Dredging Pumps are made in sizes from 2" discharge and upward, built of cast iron, carbon or manganese steel, both lined and unlined. They are belt driven or direct connected to steam engines. For the sake of economy 15-inch and larger dredging pumps are usually directly connected to compound or triple expansion steam engines. We have also many dredging pumps in service directly connected to electric motors. We can furnish pumps only or the complete dredge, including all machinery.

289



20" HYDRAULIC DREDGE with 1000 H. P. MORRIS Triple Expansion Engine, Water Tube Boilers, Cutter Machinery. This Size Dredge Has an Average Capacity of 250,000 Cubic Yards of Material per Month

STEAM ENGINES

We also build a very complete line of STATIONARY and MARINE ENGINES, in single cylinder, compound and triple expansion types.

Write for complete catalogue.



PLATT IRON WORKS

GENERAL OFFICES: DAYTON, OHIO

Branch Offices in Principal Cities

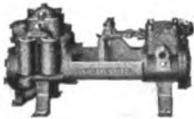
"Platt" Centrifugal and Turbine Pumps; "Smith-Vaile" Steam and Power Pumps and High Duty Pumping Engines; "Stilwell" Feed Water Heaters; "Victor-Francis" Low and High Head Water Wheels; "Smith-Vaile" Oil Mill Machinery and Equipment



PLATT DOUBLE SUCTION CENTRIFUGAL PUMPS

Split case features insure accessibility. Their rugged construction guarantees efficient and continuous service whether installed where every facility is at hand, or in the most isolated parts of the world.

Bulletin No. 762 fully describes them.



SMITH-VAILE YOKE TYPE BOILER FEED PUMPS

Provided with removable and interchangeable water cylinder linings and adjustable packed water pistons, permitting compensation for wear.

Bulletin No. 780 will interest every engineer.



STILWELL FEED WATER HEATERS

Class "O" Type

Either Thoroughfare or Switch Valve Type. Fitted with float controlled or water seal overflow as may be necessary. Single piece castings, special design for raw water control, perfect filtration, make them pre-eminent.

Bulletin No. 783 is descriptive.

VICTOR-FRANCIS HIGH AND LOW HEAD WATER WHEELS

The epoch-making installation of Victor Francis equipment to produce 50,000 horse power at Cohoes, N. Y., indicates the high efficiency that can be obtained with well designed and carefully built Platt products.

Bulletins Nos. 619 and 710 describe the line.



SMITH-VAILE COMPOUND DUPLEX PUMPING ENGINES

Economical steam construction by multiple expansion. Undeveloped energy of steam after the completion of the stroke in initial cylinders is conserved and employed in expansion cylinders. A saving of from 25 to 35 per cent.

Bulletin No. 780 gives details



SMITH-VAILE TRIPLEX PUMPS

Belt Drive Chain Drive Direct Geared

Four bearings insure reliability for day-by-day service in a practically unlimited range of application. May be belt driven from any available source of power, or direct connected by coupling, gears or chain to any form of motive power.

See Bulletin No. 741.



No matter whether they are installed under the most favorable conditions or in the most isolated parts of the world, Platt Products are pre-eminent for quality and service.

Engineers, specially trained for particular problems, are maintained in every department. This assures you the best possible service.

Catalogs, bulletins, drawings and complete data covering our lines sent promptly on request.

LAMMERT & MANN CO.

WOOD & WALNUT STS., CHICAGO, ILL.

Manufacturers of Rotary Vacuum Pumps, Centrifugal Pumps, Pressure Pumps
Engineers—Machinists

LAMMERT VACUUM PUMPS

Pistonless

Valveless

Rotary

Our pumps are designed for the *highest possible dry vacuum* and meet a long-felt want for a high grade, high duty pump, where a high, dry vacuum is required.

To give an even high vacuum there must be no valves to leak or stick, no piston and rings to wear out and the lubrication must be perfect. The Lammert pump not only meets these vital requirements, but does it with reliability, low maintenance cost and minimum power.

We avoid wear and leakage by the use of simple device peculiar to the Lammert pump and by constantly flooding oil upon the working parts by automatic oilers.

With our new silencer and the absence of reciprocating parts, the Lammert pump is free from noise and vibration.

Lammert vacuum pumps are made in several styles and sizes to meet the various demands of service.

The smaller, light service pumps, which are capable of easily attaining a vacuum of 26 inches of mercury, are air-cooled, having exceptionally large radiating surface for that purpose.

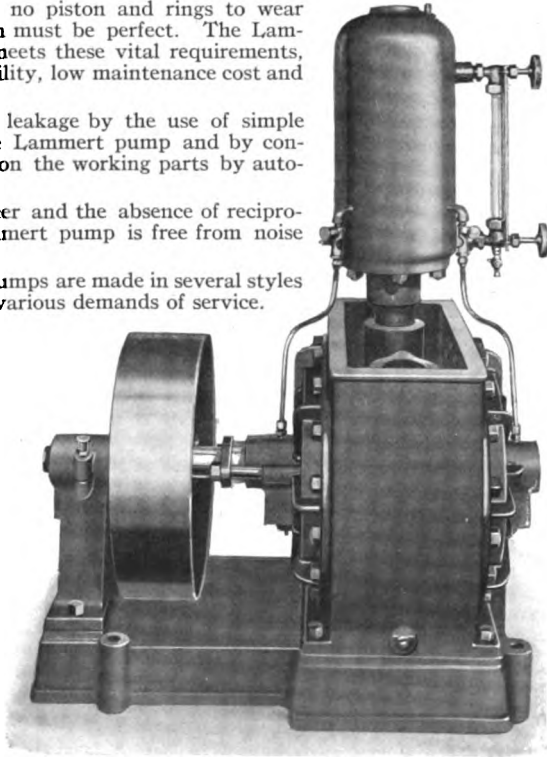
The oiling system in these pumps is of the capillary type. The oil reservoir holds a supply sufficient to run the pump for thirty hours. No oil is wasted as the oil starts and stops coincident with the starting and stopping the pump.

The larger pumps are water-cooled and are capable of easily maintaining continuously a vacuum of 27 inches of mercury at sea level.

With the tandem high duty, water-cooled pumps we can maintain the highest possible vacuum.

CENTRIFUGAL PUMPS—CONTRACT WORK.

We also build rotary pumps to handle the heaviest products.



Single Stage Water-Cooled Pump



R. D. WOOD & COMPANY

PHILADELPHIA, PA.

Engineers, Iron Founders, Machinists:—Water and Gas Works Appliances, and Pumping Machinery; Cast Iron Pipe; Gas Holders, Purifiers, Condensers, Coal Gas Plants; Hydraulic Tools and Machinery, Pumping Engines, Centrifugal Pumps; Gas Producers, Gas Producer Plants for Power, Fuel and Metallurgical Purposes, Theisen Washers; General Machinery, Large Loam Castings; Sugar House Apparatus; Valves and Hydrants

CAST IRON PIPE

Bell and Spigot Pipe from 1 inch to 84 inches in diameter, Flange, Special deep bell, High Pressure, Flexible joint for Submarine Work, Standard and Special Fittings, Heavy Loam and Dry Sand Castings.



PUMPING ENGINES

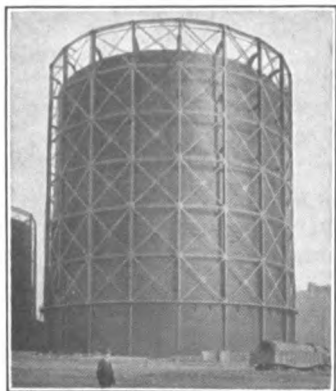
Vertical Triple Expansion, and Direct Acting for Water Works, Sewage, Irrigation and for high pressures. High duty pumping engines of both the crank and fly wheel and direct-acting types. Designed to combine highest economic duty and efficiency with greatest reliability and utmost simplicity.

Estimates and drawings (either exact or preliminary) furnished upon application, with statement of requirements to be fulfilled.

CENTRIFUGAL PUMPS

For Water Works, High Pressure Fire Systems, Irrigation Reclamation, Dredging, Sewage, etc.

Superior in Design—High Efficiency—Reliable Service.



Gas Holders—Single or Multiple Lift—any Capacity.

Heavy Tank and Plate Work.

Purifiers, Scrubbers, Condensers, Gas Works Appliances.

Coal Gas Plants.

Bench Work, Center Seals.

Gas Valves.



R. D. WOOD & COMPANY

HYDRAULIC MACHINERY

Hydraulic Presses of every description for the heaviest work, Steam Hydraulic Forging Presses, Punches, Shears, Riveters, Intensifiers, Hoists, Pressure Pumps, Cranes, Valves, etc., etc. For the majority of operations to which hydraulic power can be applied, and especially those requiring very great force exerted through a comparatively short stroke, as in riveting, punching, shearing, lifting, forging and flanging, there is no other system at all comparable with it for efficiency, uniformity, simplicity or economy. This is true for several reasons; primarily in that there is absolutely no motion or power consumed except in the act and at the moment of performing the desired operation.

HYDRAULIC VALVES

Hydraulic Operating Valves, Check, Foot, Stop and Shock Relief Valves

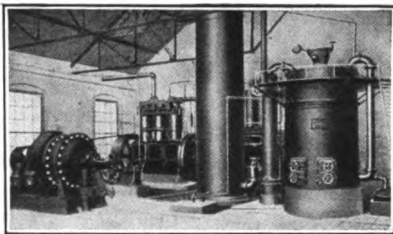
A high grade valve is an essential to the satisfactory operation of hydraulic machinery.

We are building a patented type of operating valve which is giving excellent service. We have also a special line of Check, Foot, Stop and Shock Relief Valves.

PRODUCER GAS PLANTS

We have had years of experience in the building of producers for all kinds of fuel purposes as well as for power, and our customers may be certain of securing apparatus suitable to their requirements both from an economic and operating standpoint.

Our engineering department is at your service, and we would be pleased to have our representative visit your plant and give full details.



295

GAS WASHERS

We control for the United-States the Theisen Gas Washing Process, which we build for producer and blast furnace gas. This Process was adopted by the United States Steel Company at Gary, and is being put in with all their new construction. It delivers the gas to an engine cleaner than the air in the mixture.

GENERAL MACHINERY

Our shops are well equipped for building large machinery of every description, such as sugar, chemical and similar work.

IRON CASTINGS

We are especially well equipped for making large and intricate loam castings; also castings in dry sand and green sand.

HYDRANTS AND VALVES

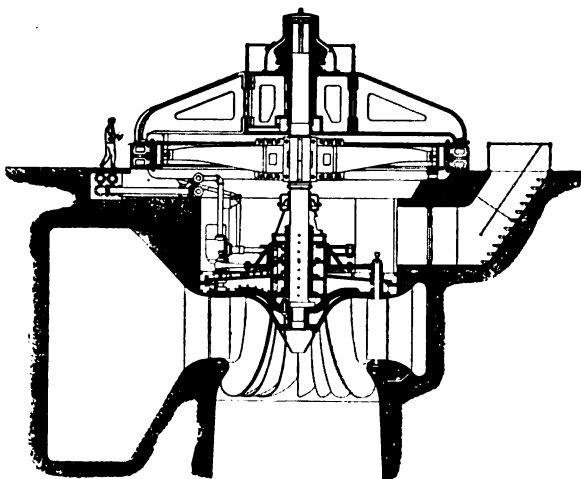
Fire Hydrants, Mathews patents for standard and high pressure. Gate, Check, Foot and Air Valves, Valve Boxes, Indicator Posts, Foot Valve and Intake Screens, Hood Racks, etc.

I. P. MORRIS COMPANY

HYDRAULIC DEPARTMENT

PHILADELPHIA, PA.

Specialists in the Design and Construction of High Class, High Power and High Efficiency Hydraulic Turbines



LARGEST TURBINE EVER CONSTRUCTED

Cross section through 10,800 H. P. turbine in the plant of the Cedar Rapids Mfg. & Power Co., St. Lawrence River, Canada. The I. P. Morris Company designed and built nine main units of this size, three exciter units, all the governors and the central pumping system.

296

Among the contracts for turbines of this type recently awarded to the I. P. Morris Company may be mentioned:

APPALACHIAN POWER COMPANY,
New River, Va.

Station No. 2. 4—6,000 H. P. Turbines
Head 49 feet, Speed 116 R. P. M.
Station No. 4. 3—3,500 H. P. Turbines
Head 34 feet, Speed 97 R. P. M.

MISSISSIPPI RIVER POWER COMPANY,
Keokuk, Iowa

8—10,000 H. P. Turbines
Head 32 feet, Speed 57.7 R. P. M.

J. G. WHITE & Co.,
Stevens Creek Development, Georgia

5—3,125 H. P. Turbines
Head 27 feet, Speed 75 R. P. M.

ALABAMA POWER COMPANY,
Coosa River, Alabama

4—17,500 H. P. Turbines
Head 68 feet, Speed 100 R. P. M.
1—19,500 H. P. Turbine
Head 68 feet, Speed 100 R. P. M.

CEDAR RAPIDS MFG. & PR. CO.,
St. Lawrence River, Canada

9—10,800 H. P. Turbines
Head 30 feet, Speed 55.6 R. P. M.
3—1,500 H. P. Turbines
Head 30 feet, Speed 150 R. P. M.

LAURENTIDE COMPANY, LTD.,
Grand Mere, P. Q., Canada

6—20,000 H. P. Turbines
Head 76 feet, Speed 120 R. P. M.

NORTHERN ONTARIO LIGHT & POWER CO.,
Fountain Falls, Cobalt, Canada

2—1,500 H. P. Turbines
Head 30 feet, Speed 150 R. P. M.

TURNER FALLS POWER & ELECTRIC CO.,
Turner Falls, Mass.

4—9,700 H. P. Turbines
Head 54 feet, Speed 97.3 R. P. M.

PENNSYLVANIA WATER & POWER CO.,
McCall Ferry, Pa.

1—16,500 H. P. Turbine
Head 63 feet, Speed 94 R. P. M.

COLUMBIA MILLS CO.,
Minetto, N. Y.

6—2,200 H. P. Turbines
Head 17.5 feet, Speed 68.2 R. P. M.

NORTHERN CANADA POWER CO., LTD.,
Sandy Falls Station,
Timmins, Ont., Canada

1—2,500 H. P. Turbine
Head 34 feet, Speed 136.5 R. P. M.

Total capacity of turbines built or under construction by I. P. Morris Company, 1,794,000 horse-power, of which turbines aggregating 517,600 horse-power are of the type illustrated above.



THE PHILADELPHIA DRYING MACHINERY CO.

MAIN OFFICE AND WORKS

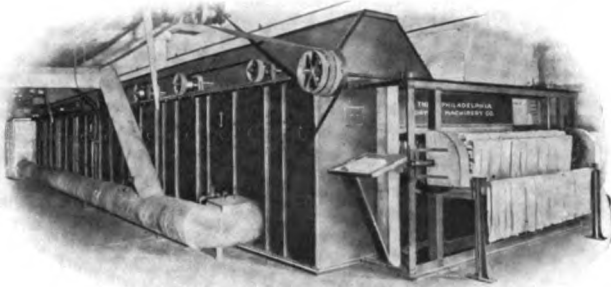
6721 GERMANTOWN AVE., PHILADELPHIA, PA.

BOSTON OFFICE: 53 STATE ST.

Manufacturers of Dyeing, Bleaching and Drying Machinery

"HURRICANE" DRYING MACHINERY

"HURRICANE" Fire-Proof Dryers, constructed of steel and insulated with asbestos, are the most economical Drying Machines.



"Hurricane" Automatic Yarn Drying and Conditioning Machine

The most scientific and economical method of handling skein yarn of all kinds.

We build Dryers of any size or capacity required, with conveying aprons to handle cotton, wool, hair, tobacco, etc.

Also Automatic and Truck Dryers for all forms of fibres and fabrics, leather and fibre board, as well as fruits and chemicals, or special machines for any materials that can be dried with heated air.

Write for illustrated catalog, stating material to be dried and quantity.

"HURRICANE" BLEACHING AND DYEING MACHINERY

Our latest improved machine with positive pump circulation gives the best dyeing at the least expense.

We build machines of various types for bleaching and dyeing of hosiery, slubbing, skein yarn, etc.

Built in standard sizes of wood, iron, bronze, or special metals according to requirements.

Complete information and descriptive catalogs sent upon request.



Rotary Circulating, Dyeing and Bleaching Machine

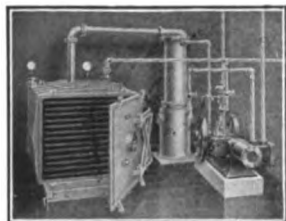
J. P. DEVINE COMPANY

BUFFALO, N. Y.

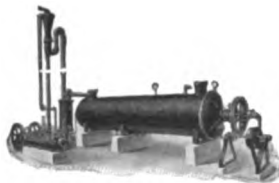
Manufacturers of Vacuum Drying and Impregnating Apparatus



Devine Vacuum Drum Dryer



Devine Vacuum Drying Chamber
with Surface Condenser
and Vacuum Pump



Devine Rotary Vacuum Drying
Apparatus



Devine Impregnating Outfit

VACUUM PUMPS—all sizes and capacities, high efficiency units, steam, belt or motor driven.

CONDENSERS—Jet and Surface Type.

DIGESTORS, EXTRACTORS, STILLS, FILTERS, WASHERS, PERCOLATORS.

SOLVENT RECOVERY APPARATUS. TANKS of all descriptions.

The World's Premier Vacuum Specialists.

VACUUM DRUM DRYERS for Dyewood and Tanning Extracts, Milk and Food Products, Pastes, etc. This type of machine affords a rapid and uniform drying because the drum takes up but a very thin film of the wet material. The water is then evaporated from the material, leaving the dried substance on the drum to be taken off by our improved method. The drying process is continuous and independent of climatic conditions, free from dust, and uniform. Adapted for all solutions and liquors containing solids.

VACUUM CHAMBERS DRYERS for Colors, Dyes, Extracts, Salts, Rubber, Smokeless Powder and High Explosives and other Chemicals and Food Products. Materials which are difficult to dry in the atmosphere without decomposition can be handled rapidly and efficiently in this type of dryer without any danger of impairing their qualities. The Vacuum Drying Chamber is designed to remove the water rapidly and at a low temperature assuring uniform drying and low operating cost. Best suited for all materials that can be handled on trays or pans.

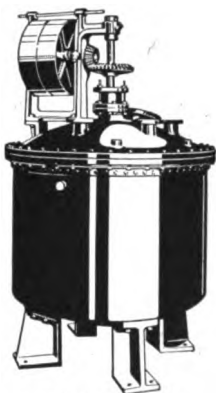
VACUUM ROTARY DRYERS for Starch, Granular Substances and Chemical Products. The moist material is charged into the dryer and by means of a high efficiency Dry Vacuum Pump and Condenser, furnished as part of the unit, a high vacuum is produced, the vapor being pulled over into the condenser and condensed. Concentric with steam-jacketed outside cylinder is a revolving drum, heated by live or exhaust steam, to which stirring blades are attached. Material to be dried is between the inside drum and outside cylinder, kept in constant motion by the stirring blades. Thus, every particle comes into intimate contact with the heating surfaces, periodically, and a thorough, even drying results. Designed for all material that can be tossed or mixed in the drying.

IMPREGNATING APPARATUS for Armature, Field, Magnet and Transformer Coils, Power and Telephone Cables, Piano Sharps, Pencil Slats and other Wood Products, Leather Fabrics, etc. This is a combination vacuum drying and impregnating apparatus, the coils or material to be handled first being dried under vacuum, thereby removing both air and moisture from the interior as rapidly as from the surface. The compound is then drawn into the impregnating tank and penetrates to the innermost recesses of the material, and to render this penetration more thorough, air at artificial pressure is admitted into the Impregnation Tank above the surface of the compound.

J. P. DEVINE COMPANY

BUFFALO, N. Y.

Manufacturers of Chemical Plants and Evaporating Apparatus



Nitrating Kettle

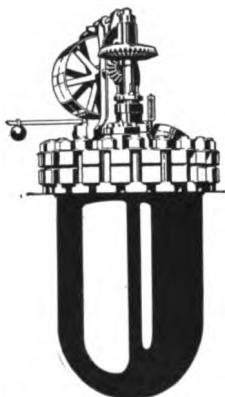
AUTOCLAVES, all sizes and capacities, of cast steel for high pressure, also of bronze, copper, etc., equipped with or without stirring device, thermometer, pressure and safety valves, and all necessary openings in cover.

Autoclaves built in units having a holding capacity of $\frac{3}{4}$ gallon to 250 gallons, and for working pressure up to 1000 lbs.

NITRATING, SULPHONATING AND FUSION KETTLES—all sizes and capacities made of all materials for any requirement.

These units built with or without stirring device, and supplied with or without reflux condensers.

Units also arranged for heating with fuel oil, gas, or steam jacketed.



High Pressure Steel Autoclave

COMPLETE PLANTS BUILT AND INSTALLED

For the production of Aniline Oil, Benzol, Beta Naphthol, Paranitraniline, T. N. T., Salicylic Acid, H. Acid, Naphthalene, Dimethylaniline, Dimethyldiphenyl Urea, Sulphur Black, all of the coal tar derivatives, the higher intermediate colors and dyestuffs, etc., etc.



Devine Vacuum Pan

VACUUM PANS, EVAPORATORS, in single or multiple effect, all sizes and capacities, made of cast iron, sheet steel, copper, bronze, etc., with horizontal or vertical tubes, and calandria type.

DIGESTORS, STILLs and COLUMNS, built for the handling of all materials, and arranged for all requirements.



Devine Digestor and Condenser

EQUIPMENT FOR THE CHEMICAL AND ALLIED INDUSTRIES

CASTINGS FOR THE CHEMICAL TRADE

CAUSTIC POTS,
ACID RETORTS,
DEFECATORS,

VACUUM STILLs,
VULCANIZERS,
MIXING TANKs,

STEAM JACKETED VALVES,
STEAM JACKETED PIPING,
Etc., Etc.

SPECIAL APPARATUS OF ALL KINDS BUILT BY US.

Let us know the problems you have in mind, and we feel sure our past experience and engineering staff can be of service in the solution of same.

SWENSON EVAPORATOR COMPANY

945 MONADNOCK BLDG., CHICAGO, ILL.

Cable Address—EVAPORATOR, CHICAGO

Evaporation Engineers—Manufacturers of Single and Multiple Effect Evaporators, Vacuum Pans, Beet Sugar Machinery, Paper Pulp Machinery, Leaching Batteries, Heaters and Special Apparatus for Removing Large Quantities of Water from Dilute Solutions

A MULTIPLE EFFECT EVAPORATOR offers the only economical way of removing large quantities of water with exhaust or live steam. The economy is inversely proportional to the number of effects, *i. e.*, a triple effect will remove *three times* as much water with one pound of steam as can be boiled off in an open tank and also permits the use of exhaust (2–3 lb. pressure).

SWENSON EVAPORATORS are handling practically every solution concentrated in commercial quantity, some of the products being in the following list:

Glue	Sugar	Potash	Black Liquor
Gelatine	Glucose	Caustic Soda	Nicotine
Glycerin	Steepwater	Iron Sulphate	Epsom Salts
Tankwater	Distillery Waste	Salt—Pepsin	Tomato Pulp
Beef Extract	Milk Sugar	Calcium Chloride	Tartaric Acid
Garbage Water	Malt Extract	Sodium Nitrate	Acetate of Lime

A large part of our present business consists of evaporators for potash and for coal-tar products. For potash alone we will have approximately twenty large installations in operation before the end of 1916.

We build several types of evaporators among them being the following: 1. **Standard Swenson horizontal removable tube machines** for straight concentration—this type being used for most free boiling solutions; 2. **Patented basket type evaporators** for crystallizing solutions and for bad scaling materials; 3. **Standard vertical tube pans**; 4. **Special evaporators** made of lead, aluminum, bronze—also with interior surfaces coated with some protective material that is acid resistant, such as cement, paint, tile or brick; 5. A special type—semi-film, for **foamy liquors**; 6. A new type for working under high pressure for high concentration, etc.

Each of these designs has a particular field and our long experience in evaporation specialization has resulted in the accumulation of data that enables us to work out any problem.

Let us send you a partial list of our customers and explain why we are getting all the business from the **largest users** of evaporators some of whom have bought from **thirty to forty machines**. When writing, send as many details in connection with your work as you have available so we can submit blue prints, etc.

Largest builders of evaporators in the United States.

Over 750 installations—20 years' experience.

L. O. KOVEN & BROTHER

N. Y. WAREROOMS
50 Cliff Street, NEW YORK CITY

OFFICE AND WORKS—JERSEY CITY, N. J.

Engineers, Manufacturers, Machinists and Designers. We Fabricate Plate Steel, Copper, Brass, Tin, Aluminum, etc., of Any Shape. Designers and Makers of Special Apparatus for Manufacturing Industries

We are prepared to do plate work of every description for Ships, Mills, Mines, Factories, Plantations, Chemical Works, Paint Works, Paper Mills, Abattoirs, Fertilizer Plants, Water Works, Government Work, Sewage Systems, etc. We also make and design Special Apparatus and Machinery to meet the progress in all lines of business. *We have the facilities for improving yours.*

A Partial List of What We Make

AUTOCLAVES	LEAD LINED TANKS
BOTTLE STERILIZERS	MALT TANKS
BREAD RACKS	METAL MELTING FURNACES
CANS	MILK MACHINERY
CAN WASHERS	MIXERS
CANNED GOODS STERILIZERS	MUFFLERS
CHEESE VATS	OIL FILTERS
CHINA KILNS	OYSTER WASHERS
COIL BOILERS	PERCOLATORS
CONDENSED MILK COOLERS	PIE RACKS
COPPER LINED STEEL TANKS	PIPE (RIVETED)
CREOSOTING TANKS	PLATING TANKS
DIGESTERS	SAND BLAST TANKS
DRINKING GLASS STERILIZERS	SHIPPING DRUMS
DRYING APPARATUS	SPRAYERS, FRUIT TREES
EXHAUST MANIFOLDS	SPRAYERS, PAINT
EXTRACTORS	SOLVENT RECOVERY STILLS
FRUIT WASHERS	STEAM KETTLES
GALVANIZED TANKS	STERILIZERS
GASOLINE TANKS	STILLS
GASOMETERS	SMOKE STACKS
GLASS KILNS	TANKS (AIR, GAS, OIL AND WATER)
GLASS STERILIZERS	TUMBLERS
GLUE DISSOLVERS	VACUUM PANS
GUM WASHERS	VARNISH TANKS
HAM BOILERS	VEGETABLE WASHER
HOT WATER TANKS	VULCANIZERS
HUMIDIFIERS	WASHERS FOR CANNERIES
JACKETED TANKS	WATER STILLS
KILNS	

WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

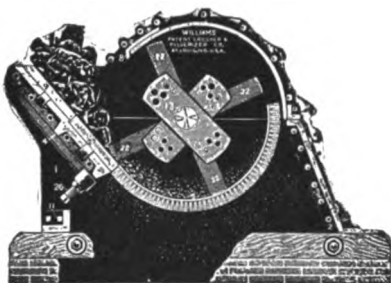
OLD COLONY BLDG., CHICAGO

BRANCH OFFICES: NEW YORK, SAN FRANCISCO, PHILADELPHIA, PITTSBURGH, CLEVELAND, DETROIT, RICHMOND, VA.

WORKS: ST. LOUIS

Manufacturers of Crushing and Grinding Machinery

COAL CRUSHERS FOR COKE OVEN WORK, BY-PRODUCT AND BEEHIVE OVENS



By the use of the Williams Patent Hammer Crushers with the various adjustable features, the following results are obtained from the ovens: The oven pulls easier, more coke is made from each oven, the ash is reduced, the coke comes out firm, regular in size, does not crumble, and the structure is much improved.

The substantial construction of these machines is plainly shown in this cut; all parts subject to wear are easily adjustable, which includes the hammers, the discs, the cage bars, and the breaker plates. The housing is entirely protected from wear by heavy liner plates made of heavy chilled iron. The machine is very accessible, as it is made of sectional construction.

SPECIFICATIONS REGULAR CRUSHER

Size Mill	Hopper Opening	Size Feed	Capacity Tons per Hour			Speed	Size Pulley	Extreme Dimensions			Horse Power	W'ght	
	In.		$\frac{1}{2}$ " & finer	$\frac{1}{4}$ " & finer	$\frac{1}{2}$ " & finer	R. P. M.	Dia.	Face L'gth	Wth.	H'ght		P'nds	
1	15x12	Run of Mine	30-40	25-30	20-25	1000	20"	15"	6'	6'6"	3'9"	20-25	6500
2	20x12		45-55	40-50	30-40	1000	20"	15"	6'	7'6"	3'9"	30-35	7500
3	30x16		65-80	60-70	45-60	1000	20"	15"	6'	8'6"	3'9"	50-60	9500
4	40x18		100-115	80-90	60-80	1000	24"	18"	6'	9'0"	3'9"	75-80	10500
5	50x20		120-140	100-110	75-100	1000	24"	20"	6'	9'6"	3'9"	100	12000
6	60x20		150-175	115-130	100-120	1000	24"	22"	6'	11'0"	3'9"	125	16200

JUMBO SPECIFICATIONS

5	30x24	R.O.M.	150-175	120-140	80-100	750	24"	18"	8'10"	9'	5'4"	85-100	20000
6	36x24		180-200	145-165	120-140	750	30"	20"	8'10"	10'	5'4"	140-150	24000
7	48x30		225-250	200-220	150-175	750	30"	24"	8'10"	11'	5'4"	165-185	28000
8	60x30		275-300	250-275	180-200	750	30"	24"	8'10"	13'	5'4"	200-250	30000

CRUSHERS FOR ANTHRACITE MINE REFUSE

Our Patent Hinged Hammer Débris Crushers are in extensive use for properly crushing and treating Anthracite débris or Culm before flushing it into the mines.

CRUSHERS FOR CHAIN GRATES OR STOKERS

The Williams Patent Coal Splitter takes Run of Mine Coal and reduces the same to $\frac{1}{2}$ ", $\frac{1}{4}$ ", 1", $\frac{3}{4}$ " and finer with the "minimum amount of fine dust," the only machine made that can be regulated to properly size coal. All parts are adjustable to wear; the crusher is also adjustable to give most any size coal desired.

BRIEF SPECIFICATIONS

No. of Crusher	Hopper Opening, Inches	Weight	Horse Power	Capacity—Tons per Hour R.O.M. to $\frac{1}{2}$ " and Finer
1	15x12	6500	15 to 20	25 to 40
2	20x12	7200	20 to 25	50 to 60
3	30x16	9500	40 to 50	75 to 100
4	40x18	10500	60 to 75	100 to 125
5	50x20	12000	85 to 100	135 to 175
6	60x20	16200	100 to 125	180 to 220

We also crush Coal and Pitch for Briquette Plants—for Coal Washers, before and after washing, and make a specialty of sizing Coal for all Commercial Purposes.

WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

RAW MATERIAL GRINDERS FOR CEMENT AND GYPSUM PLANTS

UNIVERSAL MILL

This *Universal Grinder* is the *only* machine of its kind made. Will take DRY 2" Limestone, Shale, Clay, or Coal, and deliver at one operation a product 95% through 20 mesh, TUBE MILL FEED WITHOUT OUTSIDE SCREENS OR SEPARATORS. *No other* machine can deliver the fine uniform product year in and out.



COMPLETE SPECIFICATIONS UNIVERSAL MILLS

Size Mill	Size Feed	Diam. Mill	Capacity Per Hour		Speed	Horse Power	Floor Space Extreme Dimensions			Size Pulley		W'ght
			Dry	Stone								
			12 Mesh	20 Mesh	R.P.M.		L'gth	Width	Height	Diam.	Face	P'nds
0	1"	18"	3/4	1 1/2	1800	10-12	5'	5' 1"	3' 2"	8"	8 1/2"	2500
1	1 1/2"	26"	2-4	1-3	1600	15-20	6' 3"	5' 10"	3' 8"	16"	10 1/2"	4000
2	1 1/2"	26"	5-6	3-5	1600	20-25	6' 3"	6' 3"	3' 8"	16"	12 1/2"	5000
2xx	2"	26"	6-8	5-6	1600	30-35	6' 3"	7'	3' 8"	20"	15"	6500
3	2"	40"	10-12	8-10	1100	50-60	7' 6"	6' 10"	5' 4"	20"	15"	12000
4	2 1/2"	40"	13-15	10-13	1100	65-75	7' 6"	7' 10"	5' 4"	20"	18"	14000
5	2 1/2"	40"	16-20	15-18	1100	80-100	7' 6"	8' 6"	5' 4"	20"	20"	16500
9	3"	60"	25-35	20-30	750	150-175	12'	9' 2"	7' 2"	30"	24"	30000

VULCANITE RE-CRUSHER

These Vulcanite grinders will take raw material, limestone, shale, clay or coal in cubes of 3 inches and under, and reduce the same to 1/2 inch or 1/4 inch. This makes an excellent feed for those plants which use roller mills as finishers in the raw end.

VULCANITE SPECIFICATIONS

Size Mill	Hopper Opening	Size Feed	Capacity Tons per Hour			Speed	Horse Power	Extreme Dimensions			Size Pulley		W'ght
			1/2"	3/8"	1/4"			L'gth	Width	Height	Diam.	Face	
1	14"x 5"	1 1/2"	4	3	2	1500	15-18	4' 8"	6' 3"	3' 3"	16"	10 1/2"	4200
2	18"x 6"	2"	7	5	3	1500	20-25	4' 8"	6' 6"	3' 3"	16"	12 1/2"	5000
2xx	24"x 6"	2"	10	8	6	1500	30-35	4' 8"	7'	3' 3"	20"	15"	6000
3	18"x 8"	2 1/2"	20	18	15	1000	40-50	5' 2"	7'	4'	20"	15"	10000
4	24"x 8"	3"	30	27	25	1000	70-75	5' 2"	7' 4"	4'	20"	18"	12000
5	30"x 8"	3"	35	30	28	1000	90-100	5' 2"	8'	4'	20"	20"	14000
6	36"x 10"	3"	40	35	30	1000	110-125	5' 2"	9'	4'	20"	22"	15500
7	40"x 10"	3"	50	42	35	1000	125-150	5' 2"	9' 6"	4'	22"	24"	17500

We issue the following catalogs:

No. 45-E, Coal Crusher Catalog—For all those crushing and grinding coal, etc.

No. 45, Cement and Limestone Catalog—Limestone, Gypsum and Similar Grinders.

No. 45-B, Fertilizer Catalog—Bone, Tankage, Shells and Fertilizer Work.

No. 45-A, Clay Catalog—Clay, Shale, etc., for Brick, Tile and Terra Cotta.

No. 45-C, Oil Cake Catalog—Linseed, Cottonseed and Similar Oil Cake Grinders.

No. 45-F, Shredder Catalog—Bark, Chips, Cork and all Fibrous Materials.

No. 45-D, Stock Food Catalog—All Cereals for Feed Millers, Alfalfa, etc.

Mention material you wish to crush or grind and we shall see that you receive the proper catalog and specifications.

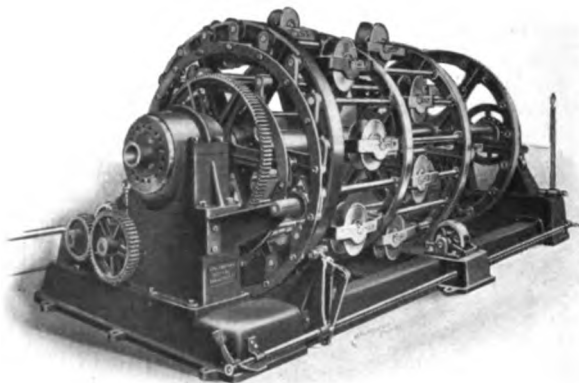
NEW ENGLAND BUTT COMPANY

PROVIDENCE, R. I.

European Agents: Selson Engineering Company, Ltd., LONDON, ENGLAND

Manufacturers of Braiding Machinery; Machinery for Insulating Wires and Cables, also Machinery for the Manufacture of Wire Ropes and Cables

CABLING AND STRANDING MACHINERY



24 Reel Horizontal Cabling Machine

These machines are used for the manufacture of wire ropes and also in making electrical conductors. They are built in all sizes and in various types for different purposes.

BRAIDING MACHINERY

American and German Type

Used for making plain and fancy braids for dress trimmings and millinery, round and flat shoe laces, soutache braids, candle wicking, tapes, cords, banding, clothes lines, fish lines, packing, gas tubing and rubber hose, round and flat elastic.

Sash Cord Braiders for making solid sash and curtain cord of various sizes.

Sash Cord Finishers for polishing solid sash cord.

Silk Covering Machines for covering cotton with silk.

Braid Spooling and Measuring Machines.

Rubber Spreading Machines, built of any desired width for applying a thin coating of rubber to cloth.

INSULATING MACHINERY

Single, Double and Triple Deck Braiders

These are made in all sizes and combinations for covering wires from small sizes up to large cables.

Magnet Wire Machinery for silk and cotton covering arranged to handle round and flat wires.

Annunciator Wire Winders, Single, Double or Triple Deck.

Taping Machinery for taping wires or cables with paper or other materials.

Polishing Machines, for insulated wires and cables from the small sizes up to 3" cables.

Wire Measuring Machines.

Twinning Machines.

Rubber Strip Covering Machines, for applying rubber insulation to wires and cables with either single or double seam. These machines are built in several sizes and handle from one up to twenty wires at a time.

TEXTILE MACHINE WORKS

READING, PA.

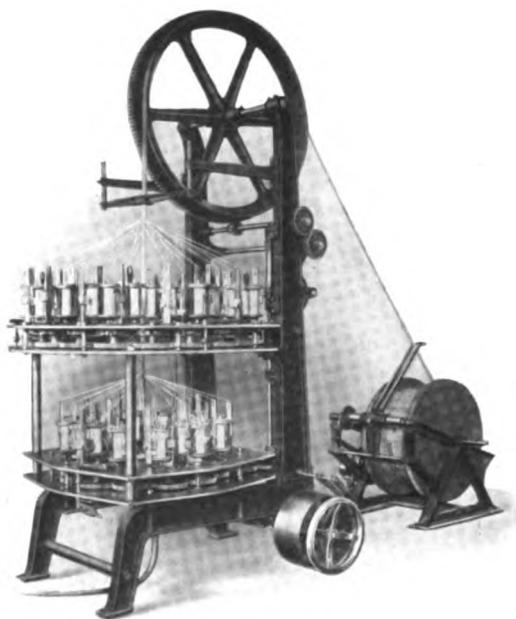
Manufacturers of Braiding and Insulating Machinery

HIGH GRADE BRAIDING MACHINES

for

Electrical Wires and Cables

and for making and armoring Rubber Hose



24 X 36 Carrier Double Deck Braider with 9" Gears

Packing Braiders

Magnet Wire Machines

Take-up Fixtures

Annunciator Wire Winders

Rubber Strip Covering Machines

Winders and Doublers

Measuring Machines, Etc.

HIGH GRADE GRAY IRON CASTINGS

THE MARSHALL FOUNDRY CO.

28TH AND RAILROAD STS., PITTSBURGH, PA.

Manufacturers of Ingot Molds and Grey Iron Castings

CAPACITY 600 TONS PER DAY



INGOT MOLDS
made from remelted as
well as direct furnace
Standard Bessemer Pig
Iron.

**GREY IRON
CASTINGS**
for all purposes—10 lbs.
to 40,000 lbs.

**STRUCTURAL CAST
IRON**
Columns, Bases, Treads,
Sills, Lintels, Guards,
Floor Plates, Trench
Plates.

**HEAVY STONE
CRUSHING CASTINGS**

We make a specialty of LARGE CASTINGS such as: OPEN HEARTH,
BESSEMER STEEL WORKS and BLAST FURNACE CASTINGS
BELLS HOPPERS EXTENSIONS TROUGHS
HEARTH JACKETS COOLING PLATES
FURNACE RUNNERS BLOW PIPES COLUMNS
SOAKING PIT COVERS, SOAKING PIT and INGOT CARS
CINDER and SLAG POTS, LADLES, THIMBLES,
LININGS; also TINNING POTS
AIR AND GAS VALVES GAS PRODUCERS

SPECIAL CASTINGS CONDENSERS PIPE SECTIONS
SPECIAL EXHAUST OUTLETS SCREENS
CHEMICAL POTS and KETTLES, STILLs, PANS, etc.,
for
CHEMICAL, SOAP, GLYCERINE, SUGAR, PAINT, VARNISH
and BY-PRODUCT COKE WORKS

INGOT MOLDS—SOLID OR SPLIT

All kinds and sizes, for Bessemer, Open Hearth, or Crucible Steel.

We have on hand PATTERNS and EQUIPMENT for all sizes of MOLDS
used in general mill work.

THE CARBONDALE MACHINE CO.

CARBONDALE, PA.

Manufacturers of Exhaust Steam Ice Making and Refrigerating Machinery; By-Product Ice Making; Paraffine Wax Plants; Filter Presses; Carbonic Acid Gas Manufacturing Machinery

MAKING ICE BY USING EXHAUST STEAM

The process is rightly termed "By-Product Ice" for the reason that power which might be wasted is utilized, labor which would be idle is kept employed profitably and inequalities in load in any kind of power plant are overcome.

Our machinery for producing these results by ice making has been developed through many years of experiment and study of this special problem. We have now developed a machine which will operate with exhaust steam taken from a general heating system, under a slight back pressure. Plants are operating successfully and economically in conjunction with the Webster and Paul system with pressure less than atmospheric. Several types of machines are built.

STEAM CONNECTION AND OPERATION

The method of making the steam connections for one of The Carbondale Exhaust Steam Machines, is shown in Fig. 1. The steam is generated in boiler (1), passed to the engine (2), the exhaust going to the feed water heater (3). The back pressure valve (4) is set at 2 to 3 lbs. when condensing water does not exceed 65°. Sufficient exhaust steam to operate the ice machine passes through the oil separator (5), where the oil is eliminated, the balance escaping to the atmosphere through the back pressure valve. After leaving the oil separator the exhaust is divided, about 60 per cent entering the coils of the generator (6) of the ice machine, where it is condensed and becomes distilled water and flows into receiver (7); the balance, 40 per cent, passes into an exhaust steam condenser (9). This consists of coils of pipes, over which the spent water from the machine flows and condenses the steam. The distilled water from this also goes to receiver (7) where it mingles with that from the generator. From this receiver it is drawn by a pump (8) and discharged into a reboiler (10) where it is further boiled to free it from any gases, etc., that may have been absorbed during condensation. The heat in the exhaust steam entering the coils of the generator is imparted to the aqua ammonia surrounding them, thus generating ammonia gas. This is later condensed and by its subsequent evaporation produces refrigeration in the ice tank coils. It will thus be seen that the exhaust steam not only supplies the distilled water necessary for ice making but also the energy required to freeze it.

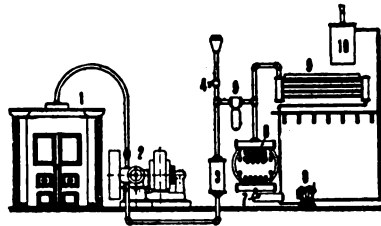
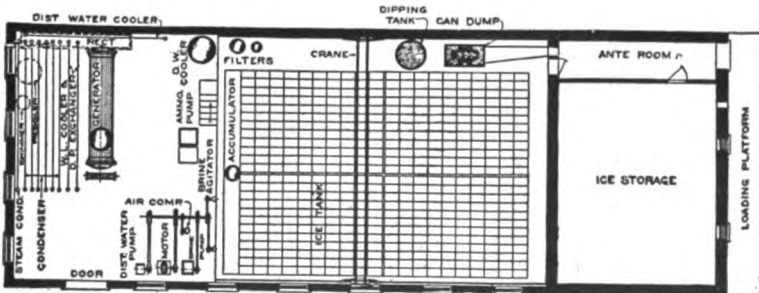


Fig. 1



Plan of Complete Plant. Absence of Boiler Equipment Is Especially Noticeable

THE H. B. SMITH CO.

WESTFIELD, MASS.

NEW YORK: 39 East Houston Street

BOSRON: 138 Washington Street, North

PHILADELPHIA: 17th and Arch Streets

Manufacturers of Boilers and Radiators for Steam and Water Heating

MILLS WATER TUBE BOILERS

Constructed in accordance with the Am. Soc. M. E. Boiler Code



No. 44 Steam Boiler

No. 24 Boiler

Nominal Width of Fire Pot 24 inches.

Rated capacity { Steam 900 ft.
to 2025 ft.
Water 1500 ft.
to 3350 ft.

No. 34 Boiler

Nominal Width of Fire Pot 34 inches.

Rated capacity { Steam 2000 ft.
to 5200 ft.
Water 3300 ft.
to 8575 ft.

No. 44 Boiler

Nominal Width of Fire Pot 44 inches.

Rated capacity { Steam 3600 ft.
to 9000 ft.
Water 5950 ft.
to 14850 ft.

No. 48 Boiler

Nominal Width of Fire Pot 48 inches.

Rated capacity { Steam 4800 ft.
to 12000 ft.
Water 7925 ft.
to 19800 ft.

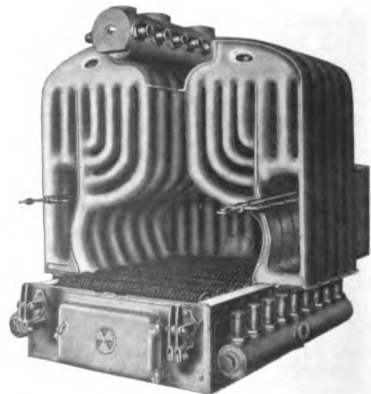
Nos. 24, 34 and 44 Mills Boilers

Maximum allowable working pressure, steam 15 lb., water 50 lb. Tested at 125 lb. hydrostatic pressure.

No. 48 Mills Boiler

Maximum allowable working pressure, steam 15 lb., water 80 lb. Tested at 200 lb. hydrostatic pressure.

Send for bulletin giving economic performance curves and other data concerning Mills Water Tube Boilers.

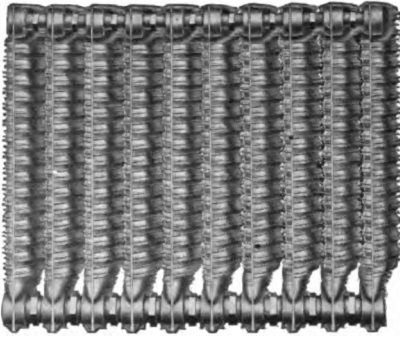


No. 44 Boiler—Interior

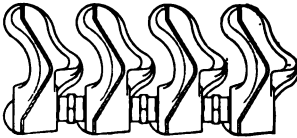
THE H. B. SMITH CO.

SMITH HOT-BLAST RADIATORS

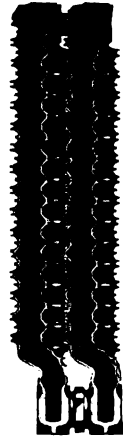
Patents Applied For



Front View of Heater Sections Assembled



Top View of Heater



Two Sections,
Vertical Sectional
View

Bulletin No. 1016 giving performance of these Heaters will be furnished upon request.

PRINCESS DIRECT RADIATORS

Malleable Iron Push Nipple connection between Sections.

Test at Factory { Two tests 100 lbs. water.
One test 80 lbs. steam.

One and two column Radiators, Sections 3" on centers.

Three and five column Radiators, Sections 3 1/4" on centers.

Send for complete Radiator Catalogue No. 1010.

SMITH SERVICE BOILER W-17

For Hot Water Supply

Maximum Allowable Working Pressure 200 lb.

Tested at 500 lb. Hydrostatic Pressure, A. S. M. E.
Standard.



Performance data of these boilers
will be sent upon request.



**CATALOGUE SECTION
PART VI**

**Measuring and Recording
Apparatus**

311

Pages 312-342

TINIUS OLSEN TESTING MACHINE CO.

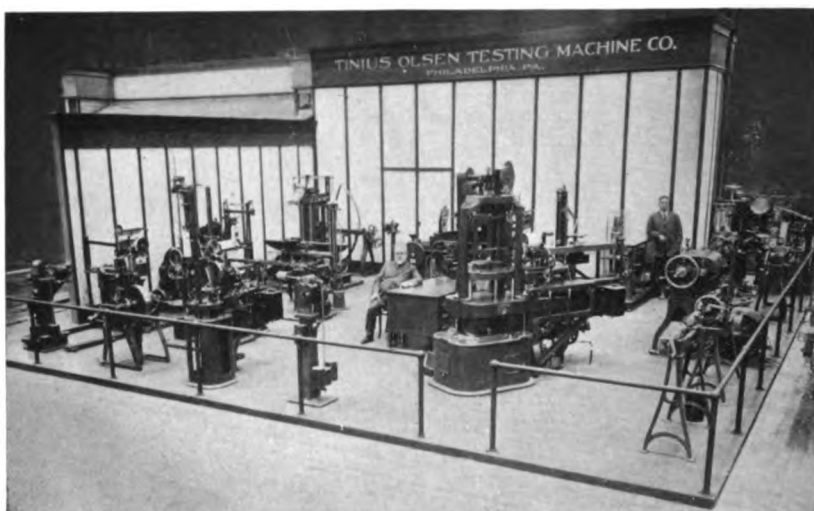
500 NORTH 12TH ST., PHILADELPHIA, PA.

Manufacturers of Testing Machinery and Instruments

OLSEN TESTING MACHINES

The following illustration is of our exhibit of testing machinery at the Panama-Pacific International Exposition in San Francisco which covers the most complete up-to-date testing laboratory ever demonstrated.

This exhibit was awarded GRAND PRIX, the highest and only award of this kind ever made to a testing machine manufacturer.



In this exhibit are thirty different types of testing machines with the addition of a complete set of accessories and instruments. The exhibit is illustrated and described by our souvenir exposition pamphlet entitled "Olsen Testing Machines," which will be mailed on request.

We are the largest manufacturers of high grade testing machines in the world.

Builders of the largest testing machine in the world of 10,000,000 lbs. capacity used by the U. S. Bureau of Standards, at Arsenal Grounds, Pittsburgh, Penna.

Our Catalog covers all the latest up-to-date testing machines and is divided into eight parts as follows:

Part A—Universal Testing Machines and Instruments.

Part B—Spring Testing Apparatus and Machinery.

Part C—Cement, Concrete and Road Materials Testing Machinery.

Part D—Cloth, Yarn, Paper, Rubber and Leather Testing Machinery.

Part E—Wire, Chain, and Anchor Testing Machinery.

Part F—Oil Testing Machinery and Dynamometers.

Part G—Transverse and Beam Testing Machines. Foundry Testing Machines.

Part H—Special Testing Machinery, Including Impact, Indentation, Vibratory, Bending, Hardness, Endurance, Torsion, Fatigue and Efficiency Testing Machines.

Any parts will be mailed on request.

Testing machines designed and built to meet any special requirements.

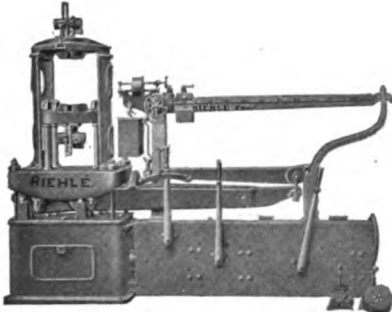
Our experts will be glad to recommend and lay out complete testing laboratories when desired.

RIEHLÉ BROS. TESTING MACHINE CO.

1424 NORTH 9TH STREET, PHILADELPHIA, PA.

Manufacturers of Testing Machines and Testing Appliances

RIEHLÉ TESTING MACHINES are used by the leading Colleges, Steel and Iron Works, United States Government, many foreign Governments, and are recommended by many of the most prominent and successful Engineers throughout the world. We design and build these machines from 5000 lbs. to 2,000,000 lbs. and over in capacity for the determination of any physical property.



Riehle U. S. Standard Vertical Screw-Power Testing Machine. Three-Screw Type, 100,000 Lbs. Capacity

Features of Riehle Testing Machines

Designed Right.
Plenty Strong Enough.
No Sparing of Material.
Long Base Lines.
Simple in Construction.
All Parts Accessible, without taking whole machine apart.
Fine Finish. Attractive in Appearance.

NOTE

We are now building all the Riehle Vertical Screw Power-Testing Machines with two (2), three (3), or four (4) Main Pulling Screws as may be desired.

For quick and convenient reference our complete line of Testing Machines is catalogued as enumerated below:

RIEHLÉ TESTING MACHINE CATALOGUE "A"

Illustrating and describing all the large Riehle U. S. Standard Testing Machines, Screw and Hydraulic Power, also new and ingenious tools for same; Machines for Long Transverse Members, Torsional and Impact Testing, also Calibrating Levers.

RIEHLÉ CATALOGUE "AA" OF EXTENSOMETERS, COMPRESSOMETERS, AND TORSION METERS

Containing illustrations and descriptions of the very latest and best Riehle Extensometers.

RIEHLÉ TESTING MACHINE CATALOGUE "B"

Embracing all the various styles of Riehle U. S. Standard Testers for Wire, Cloth, Canvas, Cord, Twine and Textile Fabrics of all kinds, also for every variety of test. This Catalogue is well worth your careful perusal.

RIEHLÉ CHAIN TESTING MACHINE CATALOGUE "C"

In this Catalogue is found all that is *newest and best* in Testing Machinery for Chain, Wire, Hemp, Rope, Eye-Bars, Bridge Irons, etc. Special Machines for different forms of materials can be designed along these lines. We also furnish Hydraulic Pumps separately if desired. We claim these Machines are the Strongest and Best in the World.

RIEHLÉ TESTING MACHINE CATALOGUE "D"

Containing illustrations of Transverse Bending, and Special Testing Machines, Rope Twisters, Loam Mills, Pipe Provers, etc. Every Foundry and Machine Shop should install some of the articles shown in this Catalogue.

RIEHLÉ TESTING MACHINE CATALOGUE "E"

Those interested in Machines for testing Springs of all kinds, also Oils and Bearing Metals, are specially referred to this Catalogue for all the newest and best Machines.

RIEHLÉ CATALOGUE "F"

In this Catalogue are presented illustrations and descriptions of superior designs and patterns of Hand and Power Hydraulic Pumps and Presses, also Riehle-Robie Patented Screw Jacks, etc.

RIEHLÉ CEMENT-TESTING MACHINE CATALOGUE "G"

In this Catalogue one will find "everything that is good" in the way of testing Cements, Asphalts, Building Material, and also every conceivable article for thoroughly equipping a Physical Testing Laboratory for that kind of work. Be sure and send for this Catalogue.

RIEHLÉ ROAD MATERIALS TESTING MACHINE CATALOGUE "K"

In this Catalogue you will find illustrations of everything to make tests of Road Materials, as used by the United States Government, Department of Public Roads, Washington, D. C.

Select the Catalogues you want when ready to order.

We are the oldest and largest Testing Machine manufacturers in the United States. Established nearly 50 years ago.

BUFFALO SCALE COMPANY, INC.

1200 NIAGARA ST., BUFFALO, N. Y.

122 Liberty St., NEW YORK, N. Y.

139 N. Clark St., CHICAGO, ILL.

Manufacture of commercial scales from the 9 oz. postal, to 400000 Lb. Railroad Track Scales. We mention below a few types and will be pleased to send complete catalog upon request.

PLATFORM SCALES

With self-aligning bearings.

With or without wheels, single, double or compound beams, platforms 15' \times 21' to 49' \times 55'.

DORMANT SCALES

With self-aligning bearings.

With all styles of beams. Platform 16' \times 25' to 60' \times 54'.

NOTE—HEAVY DUTY DORMANTS 5000 to 25000 lbs. capacity—self-contained scales, steel framed and furnished with suspension bearings, may be had in platform sizes up to 14' \times 8'.

AUTO TRUCK AND WAGON SCALES

Rigid or suspension bearing for steel or timber framing. Platforms 14' \times 8' to 28' \times 10' and all capacities up to 40 tons.

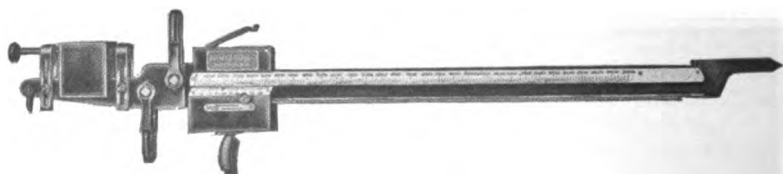
RAILROAD TRACK SCALES

Buffalo single link, suspension bearing track scales 100–150 and 200 tons. Comply strictly with American Railway Assn. specifications.

INDUSTRIAL RAILWAY SCALES

MONORAIL SCALES AND OTHER SPECIAL EQUIPMENT

Plans and full data will be sent upon request.



JOHN CHATILLON & SONS

85-93 CLIFF ST., NEW YORK

Manufacturers of Consistometers, Dynamometers, Spring Balances, Scales, Etc.

THE ABRAHAM CONSISTOMETER

(Patent Applied for)

For Determining the Hardness or Consistency of Bituminous Materials.

All readings are expressed on a single scale of Hardness ranging from 0 to 100 points. The harder the substance, the greater its Hardness or Consistency—expressed numerically.

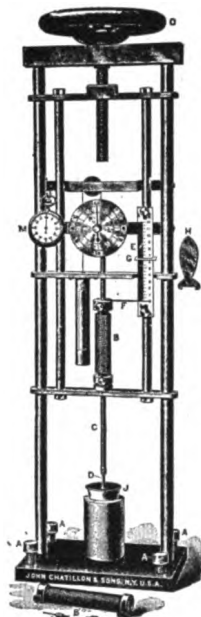
The range of the Consistometer is sufficiently great to include all commercial bituminous substances, from semi-liquids to hard brittle solids, also various bituminous compounds.

The Consistometer can be used for testing at any desired temperature, although 32 deg., 77 deg., and 115 deg. Fahrenheit are ordinarily adopted as standards.

Three plungers of special form are used.

The method of testing consists in forcing one of the plungers into the substance at a uniform speed of one centimeter per minute.

The force is automatically registered in grams. The hardness or consistency of the substance is equal to the cube root of this number of grams. A table is supplied with each machine for converting the Consistometer readings to points or measure of hardness.

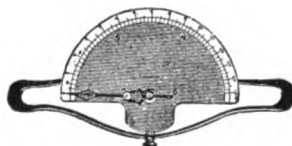


The Abraham Consistometer

DYNAMOMETERS

For Ascertaining the Draft of Ploughs, Wagons, Mowing Machines, Etc.

These Dynamometers may be had with one loose pointer to remain at maximum strain when used for testing purposes.



Dynamometer

500 lbs., 1000 lbs., 1500 lbs., and 2000 lbs. capacity by 25 lbs.
2500 lbs., 3000 lbs., 3500 lbs., 4000 lbs. and 5000 lbs. capacity by 50 lbs.
10,000 lbs., 15,000 lbs., 20,000 lbs., 25,000 lbs. capacity by 100 lbs.
50,000 lbs. capacity by 250 lbs.

HANGING SCALES

White Dial and Glass Sash

Full Capacity of Scale shown on Dial with one revolution of the Pointer.

Made with various sizes of dials, also in various capacities.



Circular Spring Balances

PLATFORM SCALES

For Counter Use

Size of Platform, 11½x14 inches. Distance from center of Dial to bottom of base 25 in.

The Dials on these scales have figures at every pound with every five pounds in red, the half-pound marks are heavy and far apart, making the Dial so plain that errors in reading are impossible.



Platform Scales

- No. 678, 50 lbs. by ½ lb., 10 inch Dial, Iron Platform
No. 679, 50 lbs. by ½ lb., 10 inch Dial, Marble Platform
No. 778, 50 lbs. by ½ lb., 13 inch Dial, Iron Platform
No. 779, 50 lbs. by ½ lb., 13 inch Dial, Marble Platform
No. 788, 100 lbs. by ½ lb., 13 inch Dial, Iron Platform

In addition to our regular line of Spring Scales, we make a great variety to order, for special purposes and of various capacities—some to register as fine as one-hundredth part of an ounce, and others as heavy as twenty thousand pounds. We can furnish scales for assorting, counting, multiplying, estimating, and also for various purposes of testing, etc.

All our Spring Scales are warranted to be accurate and perfect in workmanship.

CHATILLON

TRADE MARK

NATIONAL METER COMPANY

Established 1870

84-86 CHAMBERS ST.,

NEW YORK CITY

BRANCH OFFICES:

CHICAGO, 1227 Wabash Ave. BOSTON, 159 Franklin St. CINCINNATI, 224 East 4th St.
PITTSBURGH, 4 Smithfield St. ATLANTA, 3d Nat. Bank Bldg. LOS ANGELES, 411 S. Main St.
SAN FRANCISCO, 141 New Montgomery St. WINNIPEG, MANITOBA, 229 Spence St.
LONDON, Caxton House

Manufacturers of Water Meters and Gas Engines

THE CROWN METER is a positive displacement water meter of the rotary piston type. This meter has been made and sold by us for over thirty years. It is substantial, durable and accurate. We make this meter in sizes from $\frac{3}{8}$ " to 6".

THE EMPIRE METER is a positive displacement water meter of the oscillating piston type. It is the most accurate, durable and generally satisfactory meter manufactured today. Owing to the simple construction of its measuring chamber the accuracy of this meter can be maintained indefinitely at a minimum cost. It is made in sizes from $\frac{3}{8}$ " to 6".

THE NASH METER is a positive displacement water meter of the disc type. This meter has been on the market for over twenty-five years. The reinforced disc, frost-proof bottom and straight reading register are a few of its many superior advantages. The meter is made in sizes from $\frac{3}{8}$ " to 6".

THE GEM METER is a water meter of the velocity or current type and has been made by us since 1870. It is intended for service when a large and rapid delivery of water is of special advantage. The Gem has the greatest capacity of any meter of its type on the market. It is made in sizes from 2" to 12".

THE PREMIER METER is a water meter constructed of a Venturi Tube and a by-pass on which an accurate, positive displacement meter is installed. This meter is intended to measure the complete supply of a city or other large service. The Premier is made in sizes from 8" to 48".

THE EMPIRE COMPOUND METER is a water meter constructed by combining our Empire and Gem meters. It will measure with great accuracy large and small flows, and will operate most satisfactorily under greatly varying conditions. The Empire section is always open. The Gem section is controlled by a check valve which opens automatically when called upon to measure a stream larger than the capacity of the Empire. This meter is made in sizes from 2" to 12".

Our meters form a standard by which all others are judged.

No matter what your conditions may be, we can offer you the

Best Meter for Your Service.

WILLCOX ENGINEERING CO.

SAGINAW, MICHIGAN, U. S. A.

Manufacturers of Water Weighers



Willcox Rectangular Water Weigher with Storage Tank and Automatic Chart Recorder

THE WILLCOX WATER WEIGHER

is a device for automatically weighing and recording the water fed to boilers. It takes water from any source, such as a feed-water heater, tank, pump or hydrant, at any rate of flow or at varying rates, and delivers it intermittently in charges of uniform weight.

It will weigh hot feed water from an open heater, cold water from a hydrant, water of condensation from vacuum pans or heating systems, also chemicals, caustic solutions, volatile oils, sugar juices, etc.

Operation: The charge is weighed by a liquid column of fixed height, through the medium of an air balance. The unit charge is dumped automatically by the sudden release of the entrapped air—an extremely accurate and reliable method of balancing.

Accuracy: Each weigher is guaranteed to weigh within one per cent of perfect accuracy at any rate of supply up to its maximum capacity.

Styles and Capacities: The Willcox Water Weigher is built in several styles to suit various requirements: portable weigher for evaporative and condensing tests, and power-plant sets for permanent installation. All capacities from one thousand pounds per hour up to half a million pounds.

Plans for Installation: Suggestions, sketches and plans for proposed installations are furnished free of charge by the Willcox Engineering Company. We have competent engineers and draftsmen for the purpose of assisting prospective customers in planning suitable arrangements to meet local conditions.

Savings Secured in Boiler Plants: This simple, reliable, automatic self-recording device for continuously and accurately recording every pound of water pumped to the boilers, provides a means of segregating boiler evaporation cost from engine and generator performance, thereby determining from day to day whether or not proper evaporation is being secured per pound of coal.

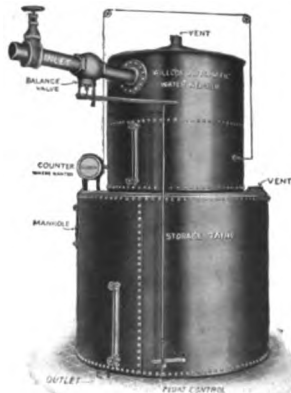
GENERAL DIMENSIONS—STYLE A, BUILT OF BOILER PLATE

Size No.	Maximum rate of weighing, in lbs. of water per hour	Size inlet, In.	Shell, thickness	APPROXIMATE	
				Ship's weight	Weight of water per unit charge
1	500,000	10	3/8	4000	5000
3	300,000	8	5/16	3000	3500
5	200,000	6	1/4	2100	2700
7	150,000	6	1/4	1850	2250
9	100,000	6	3/16	1500	1800
11	75,000	4	3/16	1200	1100
12	62,500	4	3/16	1100	1180

STYLE B—INGOT IRON

14	40,000	3	....	600	680
16	25,000	2½	....	400	420
18	15,000	2	....	275	200
20	10,000	2	....	175	120
22	5,000	1½	....	150	60

Send for Water Weigher Catalogue W-8



The Willcox Automatic Water Weigher with Storage Tank. Style A, Cylindrical

BAILEY METER COMPANY

141 MILK ST., BOSTON, MASS.

Manufacturers of Recording Meters and Testing Instruments



Bailey Fluid Meter Type C2 Recording and Integrating Flow, also Recording Pressure and Temperature

BAILEY FLUID METERS

Are the most practicable and accurate meters for recording and integrating the flow of steam to turbines, engines, heating systems, general mill use; low pressure steam, exhaust, and in fact for all purposes. Equally well adapted to measure the flow of water, air, gases and other fluids, under practically all conditions of pressure, temperature and capacity.

There are but two moving parts to this meter and they are not subjected to the direct action of the steam, hot gases or other fluid being metered. The meter is operated by a pressure difference which is produced by the fluid flowing through an orifice placed between a pair of flanges in the pipe line.

BAILEY BOILER METER

A radical departure from anything that has ever been developed.

Not only measures the steam output from the boiler, but also the air supply to the furnaces, showing whether it is the right amount, too much or too little for the best results. It shows, further, the condition of the fuel bed as to whether the fire is too thick or thin or may be provided with a flue gas recorder and sensitive fire-box draft indicator.

Helps the fireman get the best results from each boiler with respect to both efficiency and capacity.

For any type of boiler, furnace or stoker.



Bailey Weir Meter

Recording and integrating flow of water or other liquids through V-Notch or rectangular weirs. For feed water, hot well discharge, etc., at or near atmospheric pressure.

BAILEY GAS FLOW METER. Recording rate of flow of air or gas at low velocities and at or near atmospheric pressure. For measuring flue gas, mine ventilation, fan discharge, etc.

BAILEY DIFFERENTIAL PRESSURE RECORDER. Measuring pressure, suction or differential pressure of any gas or air. Extremely sensitive. Accurate to 1/1000" water. For draft in furnaces, flues, gas works, ventilating systems, mine ventilation, etc.

"THE CO₂ METHOD OF STEAM MEASUREMENT." Measuring steam flow with great accuracy regardless of pressure, temperature or density. For meter calibration and test work without any change in piping, weighing of water, or utilizing any pressure or temperature readings. Also adapted to water, air and gases.

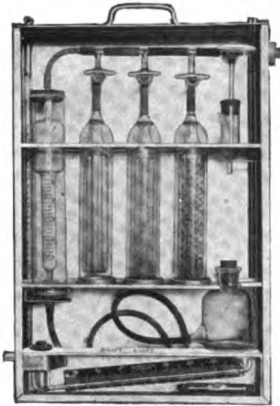
Bulletin No. 5 contains the complete line of Bailey recording meters and testing instruments. Sent free on request.



DEFENDER AUTOMATIC REGULATOR COMPANY

506 ORIEL BLDG., ST. LOUIS, MO.

Manufacturers of Combustion Appliances



DEFENDER PORTABLE BOILER ROOM TEST OUTFIT NO. 2

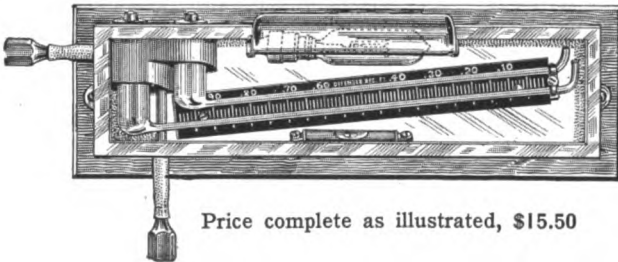
consists of Three Chamber Orsat, Flue Gas Thermometer, one Draft and one Gas Tube, one $\frac{3}{4}$ -inch Draft Gauge, all chemicals, Rubber Tubing, instructions, etc., in handsome metal case, ready for use by removing front cover, which slides out. Dimensions $16\frac{1}{2}$ by $11\frac{1}{4}$ by $3\frac{1}{2}$ in.

Price \$45.00

Fabrikoid Leather Carrying Case \$5.50 extra.

We also make four types of Gas Analysis Instruments, three types of Gas Collectors, three types of Portable Outfits for Boiler Room Testing or Traveling Engineers, and a large line of other appliances, including two types of Automatic Damper Stoker Regulators.

DEFENDER DUPLEX DRAFT GAUGE



Price complete as illustrated, \$15.50

Cast Aluminum Shades, Nickel-plated Sockets, Tungsten Frosted Lamps for 110 volts are furnished. Backs are of kiln-dried white pine, stained light shade.

Defender Draft Gauges are made in thirteen different types; all are furnished in both Right and Left Hand Gauges and with or without Gauge Boards and Lights.



PRECISION INSTRUMENT COMPANY

DETROIT, MICHIGAN

Engineers

Manufacturers of Control Apparatus



CO₂ Recorders

For all percentages of CO₂.
Accurate to 0.5 of 1% CO₂.
24 hour and 60 day types.

Our Products
CO₂ RECORDERS
INDICATING GAUGES
RECORDING GAUGES
PICO GAUGES
MICROMETER GAUGES
DIFFERENTIAL GAUGES
100 CC ORSATS
50 CC ORSATS
EFFICIENCY KITS
BOILER TESTERS
U GAUGES
SPECIAL GLASS
THERMOMETERS
GAS COLLECTORS
ARGAND BURNERS
COAL CALORIMETERS



"3 in 1" Gauge

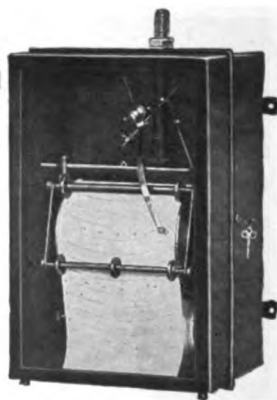
The only combination gauge on the market. Designed for either forced draft or natural draft. Requires but little space on the Gauge Board.



Recording Gauge



"PICO" Differential



60 Day Type

Our recording gauges are of the Dead Beat and Pico types, for all ranges from 0-0.5 inch of water to highest ranges. They are guaranteed for accuracy, sensibility, and durability.

Our catalogues will be sent you together with our A. B. C. of Combustion upon request.



UEHLING INSTRUMENT COMPANY

2011 EMPIRE BUILDING, NEW YORK CITY

Manufacturing Engineers—Combustion Economists

UEHLING CO₂ RECORDERS and

GENERAL POWER PLANT ECONOMY APPARATUS

Instruments for Measuring and Recording Vacuum, Pressure, Draft, Temperature, CO₂, Differential Pressure, Absolute Pressure, Barometric Pressure, Speed, Time, Etc.



Record of CO₂ and Stack Temperature on One Chart

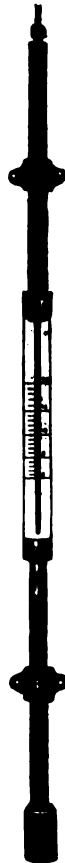
UEHLING CO₂ EQUIPMENT provides the means for obtaining and maintaining high boiler efficiency. Such equipment consists of the INSTRUMENT PROPER, which can be located in the engine-room or any other convenient part of the plant, the RECORDING GAUGE which can be located in the office of the Chief Engineer or Superintendent, and the AUXILIARY CO₂ INDICATOR which can be located at the boiler front so that the firemen can be held responsible for the fuel wasted up the chimney, just the same as he is held responsible for an even steam pressure by means of the steam gauge.

The per cent of CO₂ in the products of combustion is a true index of the excess air used, therefore the lower the per cent of CO₂, the greater the volume of products of combustion per pound of fuel consumed, and since all gases leave the boiler at stack temperature the per cent of CO₂ in the products of combustion bears a direct relation to the sensible heat wasted up the chimney.



UEHLING DRAFT ANALYZER

A Most Important Adjunct to Boiler Room Equipment



CO₂ Indicator for Boiler Front

AMERICAN STEAM GAUGE & VALVE MANUFACTURING CO.

FACTORY AND GENERAL OFFICES, BOSTON, MASS.

SALES OFFICES: NEW YORK, CHICAGO, ATLANTA, PITTSBURGH

Manufacturers of Steam Traps, Gauges, Valves, Indicators, and Kindred Appliances for Governing, Indicating, Measuring, Recording and Controlling Steam, Water, Air, Gas, Oil, Ammonia, and All Other Pressures



Bourdon Gauge

AMERICAN GAUGES are the simplest in construction, yet so designed that maximum efficiency with longest service is assured to the user. Gauges are too often judged or selected from superficial inspection only, with little or no attention to interior construction—the vital part. In American Gauges only the best material and workmanship will be found, as well as accuracy. This means dollars in every sense of the word to the owner, in both operating and maintenance expense. We furnish gauges for every purpose, and especially invite inquiries for installations

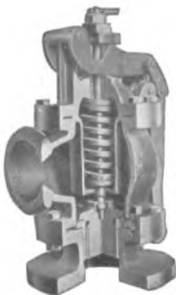
where operating conditions are unusually severe. Estimates promptly furnished.

AMERICAN RECORDING GAUGES

The economical operation of power is safely guarded by the use of accurate, durable Recording Gauges. American Recorders are constructed in the same reliable, workmanlike manner that is characteristic of all our products. The style of case is the same as our non-recording instruments, thus giving uniformity to gauge board installations. Highest grade clock movements are used, insuring accurate time records. Standard chart 8 inch, 24 hour. Special charts to order. Each gauge fitted with our improved fountain pen requiring filling monthly. We specialize in engine room gauge boards complete, and invite inquiry.



Recording Gauge



Sectional View

AMERICAN SPECIAL POP SAFETY VALVE

This valve is designed embodying the best features found in our experience during the thirty years of spring loaded safety valve existence. Constructed of the highest grade materials, tested under actual working conditions, simple, efficient, and of few working parts, all being easily accessible, and *all* adjustments made from *outside* valve casing. It is the best in valve construction.

This valve is also made in outside spring pattern for superheated steam.

Our sixty-five years record is behind our guarantee covering all goods which we manufacture.

THE ASHTON VALVE COMPANY

271 FRANKLIN ST., BOSTON, MASS.

BRANCH OFFICES: 128 Liberty St., NEW YORK. 174 N. Market St., CHICAGO, ILL.

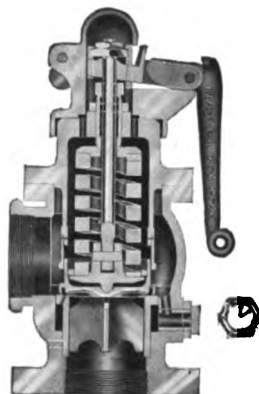
Manufacturers of Pop Safety Valves, Pressure and Vacuum Gauges and Kindred Engineering Specialties

THE ASHTON IMPROVED POP SAFETY VALVE

for forty-five years past has been the acknowledged Quality Standard among Engineers. When of suitable size Ashton Pop Safety Valves give prompt and full relief to the boiler, and it is impossible to accumulate pressure above the point at which they are set. They are sensitive in action and always reliable, protecting the boilers from dangerous overload and the plant from possible explosions.

The Ashton Pop Safety Valve also helps to insure a desirable uniform boiler pressure by operating with only a moderate blow back, which does not increase by wear to an excessive amount. Saves steam and fuel. It is perfectly automatic in its operation, with nothing to get out of order.

Ashton Pop Safety Valves are made to give any desired capacity of relief, and are furnished to comply with the A. S. M. E. specifications.



THE ASHTON IMPROVED DEAD WEIGHT PRESSURE GAUGE TESTER

offers the most modern method for obtaining an accurate testing of pressure gauges by means of weights. As accurate as a mercury column, but much more convenient and much less expensive, they are used extensively and are recognized and adopted as standard for measuring pressures.

With the style illustrated, showing double area piston, it is possible to secure both low and high pressure testing up to a maximum of 1000 lbs. per square inch, with only one-fourth the usual number of weights. Two small valves on opposite sides of vertical cylinder are the simple means of adjustment for either high or low pressure testing, and can be regulated at a moment's notice while machine is in use, without



in any way taking it apart. Single Aria Testers are furnished for maximum pressure of 200, 300 or 500 pounds.

THE ASHTON IMPROVED PRESSURE RECORDING GAUGE

assures careful firing, steady pressure, higher efficiency and greater economy. It takes a daily record on chart showing the pressure-variation down to the minutest point, both day and night, and gives the time and length of every change. The pressure line is recorded in red ink on the proper chart, which is graduated in pressure lines and fractions of an hour.

Ashton Recording Gauges are carefully constructed of the best material and with the best workmanship, assuring unerring and lasting service. They are adaptable for steam, water ammonia, air or gas. Charts can be furnished for pressure, vacuum or compound pressure and vacuum. One year's supply of charts, ink and pen filler are furnished with each instrument.



Our finely illustrated and descriptive book of 120 pages tells all about the full line of Ashton Specialties. Write for it NOW.

CROSBY STEAM GAGE & VALVE CO.

EXECUTIVE OFFICES

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STORES: BOSTON, 38 Central Street

NEW YORK, Hudson Terminal Bldg., Dey Street

CHICAGO, 180 No. Market Street

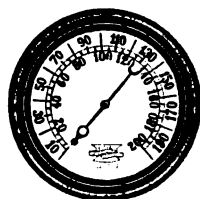
LONDON, ENG., 147 Queen Victoria Street

Manufacturers of Standard Steam Appliances

We present for the consideration of Mechanical Engineers certain instruments of our manufacture which we believe are scientifically and mechanically the best of their kind yet produced.

GAGES

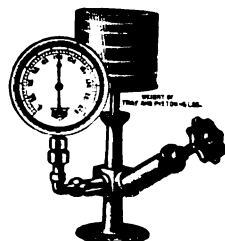
For any and all purposes.



Crosby Pressure Gage

RECORDING GAGES

Daily, weekly or continuous records for Pressure, Vacuum, Hydraulic, etc.



Crosby Pressure Gage Tester

GAGE TESTING INSTRUMENT

Made on scientific principles and is mathematically correct.

REVOLUTION COUNTERS

Positive in action, reliable, durable.



Crosby Revolution Counter

RECORDING COUNTERS

An instrument of wide application and of the greatest usefulness to engineers.

INDICATORS

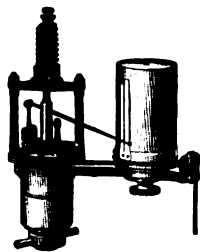
Steam, Gas, Hydraulic, etc.

As perfect in workmanship and operation as human skill can devise.

Also Lanza Continuous Diagram Appliance—Reducing Wheels—Boiler Test Pumps—Vacuum Pump—Planimeters—Electrically Operated Chime Whistles—Valves for Steam, Ammonia, etc.

All CROSBY Quality

Address any of our stores and you will receive a prompt and courteous reply.



Crosby New Indicator

J. E. LONERGAN CO.

211-215 RACE ST., PHILADELPHIA, PA.

Manufacturers of Boiler, Steam and Gas Engine Specialties

QUALITY  GAUGES



Pressure Gauge

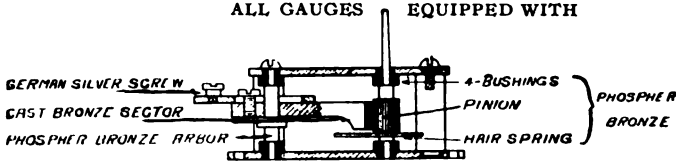


Ammonia Gauge



Hydraulic Gauge

ALL GAUGES EQUIPPED WITH



Non-Corrosive Movement—Sectional View

Mechanical Men simply read our SPECIFICATIONS and are convinced.

"Movement" for all of our high-grade gauges.

All wearing bearings have PHOSPHOR BRONZE BUSHINGS twice their diameter in length.

Sector, cast bronze, with face three times as wide as the regular sector.

Pinion, Arbor and Hair Spring, made of PHOSPHOR BRONZE.

This insures a gauge with exceptional wearing qualities, long life and accuracy.

"Springs" made for hard work.

Sector suspended vertically which reduces wear on teeth of sector and pinion to a minimum.

"Dials" all graduated by hand, made of brass, silver plated with black lettering.

Pressure Gauges for steam, water or air, or vacuum. Pressure gauges graduated to any pressure not exceeding 500 lbs. Vacuum gauges graduated to 30".

Type "D" Short Spring, strong, non-freezable.

Model "GAS" Short Spring, strong, non-freezable, with Auxiliary Helical Spring attached to end of main spring, lengthening life of gauge where fluctuation of pressure or vibration is excessive.

Model "GDS" Double Spring, strong, non-freezable, made of one piece of seamless drawn bourdon tubing, insuring accuracy.

Pressure and Vacuum Gauge: Generally used on Compound Engines, Receivers, and Heating Systems.

"Combination" Water Works Gauge: Used to indicate pressure of water per square inch and corresponding height of column of water in feet. Adapted for use in Water Works, Pumping Stations, Mines, Stand Pipes, etc.

"Altitude" Gauge: Used to indicate height of water in feet in tanks, reservoirs and in connection with Hot-water House-heating Systems. Are generally graduated to 70 feet.

Double and Auxiliary Spring "Locomotive" Gauges.

"Ammonia" Gauge: Made expressly for use with ammonia and other liquids affecting brass. Tubes are made of a very high grade steel and carefully tempered. For use on ice and refrigerating machines.

"Tractor Engine" Gauges: Generally graduated to 300 lbs.

"Hydraulic" Gauge: Can be graduated to any pressure not exceeding 20,000 lbs. per square inch.

UNITED STATES GAUGE CO.

67 WALL ST., NEW YORK, N. Y.

WORKS: SELLERSVILLE, PA.

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DETROIT

SAN FRANCISCO

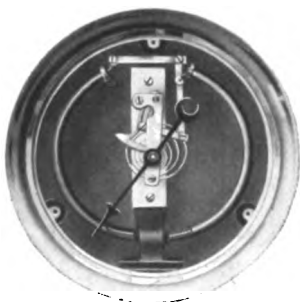
MONTREAL

Manufacturers of Pressure Gauges Exclusively



OXY-ACETYLENE GAUGES

Graduated to indicate pressure and cubic feet in standard oxygen cylinders. Patented safety features comprise solid cast front and full back safety release.



U. S. Navy standard heavy bushed movement with $\frac{1}{16}$ " face cast phosphor bronze segment and German silver pinion and arbors. Bearings deep bushed to give a bearing surface $1\frac{1}{2}$ diameters long. Specially adapted for severe vibration service conditions.



UNIVERSAL GAUGES

U. S. Standard Universal Dial Gauges, combining the American and metric standards, meet all export requirements.

IF IT'S A GAUGE WE MAKE IT

THE BRISTOL COMPANY

WATERBURY, CONN., U. S. A.

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Old South Building

CHICAGO
Monadnock Building

NEW YORK
114 Liberty St.

SAN FRANCISCO
Rialto Building

PITTSBURGH
Frick Building

Manufacturers of Bristol Recording Instruments for Pressure, Temperature, Electricity and Motion

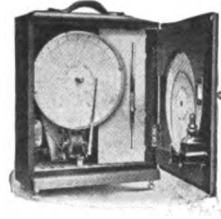


Recording Gauge

Bristol's Recording Gauges for steam, air, gas and liquids. For all ranges of pressure and vacuum.

Bristol's Recording Voltmeters for all ranges of A. C. and D. C. Can be furnished for switchboard or portable service.

Bristol's Recording Thermometers for all commercial ranges of temperature from 60° below zero to 800° F.



Portable Voltmeter



Recording Thermometer

Bristol's Electric Time Recorders for recording time of mechanical movements, machine operation, valve reversals, etc.

Bristol's Indicating Electric Pyrometers, High Resistance model, for measuring temperatures up to 3000° F.

Bristol's Recording Tachometers for recording the speed of shafting, machines, engines, etc.



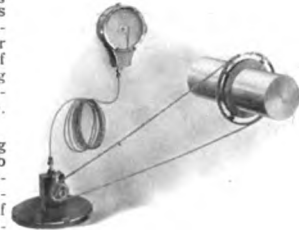
Operation Recorder



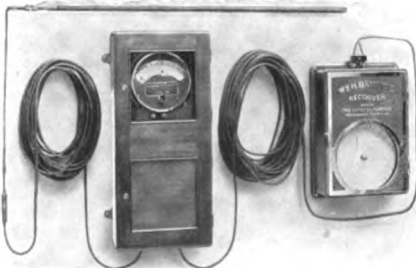
Indicating Pyrometer

Combination Indicating and Recording Unit of Bristol's Pyrometers. Indicating Instruments for operator at post of duty and Recording Instrument for superintendent in his office.

Bristol's Recording Wet and Dry Bulb Thermometer or Psychrometer for determining the degree of humidity in the atmosphere.



Recording Tachometer



Combination Indicating and Recording Pyrometer

Bristol's Recording Instruments induce uniform operating efficiency in factories, industrial works and power plants.



Recording Psychrometer

THE BROWN INSTRUMENT CO.

PHILADELPHIA, PA.

NEW YORK

PITTSBURGH

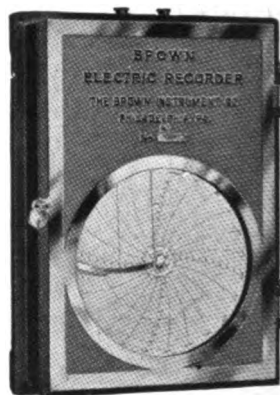
CHICAGO

Manufacturers of Pyrometers, Thermometers, Tachometers, Recording Gauges, Voltmeters and Ammeters

BROWN PYROMETERS



Indicating Pyrometer



Recording Pyrometer

328

These well-known instruments operate on the thermo-electric principal for all ranges of temperature from 300° F. to 3000° F. For temperatures below 300° F., resistance thermometers are supplied while for temperatures above 3000° F., the Brown Radiation Pyrometer is extensively used. Pyrometers are also made to regulate or control automatically the temperature of electric, gas and oil furnaces.

KEYSTONE VOLTMETERS AND AMMETERS

These well-known electrical measuring instruments are manufactured for either direct or alternating current or both. They have an exceptionally high torque and light moving element and are particularly desirable for severe service conditions.

SCIENTIFIC INSTRUMENTS

Thermometers of the mercurial type, tachometers operating on either the electric or centrifugal principle, and recording gauges are also produced in our laboratory, Wayne Junction, Philadelphia. Anyone visiting in Philadelphia will be welcome to call and inspect the manufacture and design of these instruments.

THE SCHAEFFER & BUDENBERG MFG. CO.

BROOKLYN, NEW YORK

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Instruments for Measuring, Indicating, and Recording Temperature, Pressure, and Speed

S & B GAUGES

A complete line of Pressure, Vacuum and Draft Gauges for all requirements, also Column Gauges, Mercury Pressure and Vacuum Gauges, Gauge Testers, etc.

"CRESCENT" THERMOMETERS

Among our line of high grade "Crescent" Thermometers will be found an instrument for practically every purpose, and our catalog No. 200 illustrates over seventy types. Handsome in appearance and perfect in mechanical detail and construction.

Specify size of scale case desired, graduation, character and size of connection, character and length of stem, and the purpose for which the thermometer is to be used.



"Crescent"
Thermometer

"REFORM" THERMOMETERS

A dial face, mercury-filled indicating thermometer having the accuracy of the standard glass tube thermometer and the conveniences of a dial face instrument. Entire working mechanism is made of steel, meaning long life. Standard size of dial 6 inches. Other sizes made to order. Furnished with either rigid connection or flexible capillary steel tube connection. The latter greatly facilitates installation. State the graduation desired, character and length of connection, and the purpose for which the thermometer is to be used.



"Reform" Thermometer

"COLUMBIA" RECORDING THERMOMETERS

The most simple, yet the most reliable type of Recording Thermometer. Mercury actuated, therefore, absolutely accurate. Steel construction throughout combining extreme strength and durability with accuracy. Uniformly graduated, wide and effective ranged charts with the popular day and night border, made in two sizes, 8" and 12", respectively, for 24 hours or 7 days. Furnished with either rigid connection or flexible steel protected steel capillary connecting tubing of any length. State size of chart and graduation, length and character of connection and the purpose for which the recorder is to be used.



"Columbia" Record-
ing Thermometer

THE "COLUMBIA" RECORDING GAUGE

An exceptionally accurate and reliable instrument adaptable for all ranges of pressure, vacuum and draft. In portable and stationary types, for 8" and 12" day and night charts, respectively, making one revolution in 24 hours or 7 days as desired.

State size of chart and graduations, and the purpose for which the Recorder is to be used.



The Columbia
Recording Gauge

"COLUMBIA" TACHOMETERS

We have a most complete line of Hand and Stationary Tachometers, and we have recently added many new styles and types, covering absolutely every requirement met with in practice. Constructed on the most modern principles, accuracy guaranteed, compact and durable in construction, perfect in mechanical detail and handsome in appearance.

State desired graduations and if Stationary Type or Tachometer is wanted, the diameter and the normal speed of the shaft you will drive from.

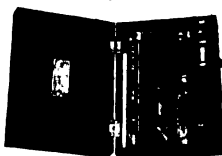


"Columbia"
Tachometer

CALORIMETERS

We manufacture Professor Carpenter's pattern Calorimeters for Steam and Coal. The throttling type of Steam Calorimeter serves for determining the amount of moisture contained in steam. The Separating type is designed to show the percentage of water by mechanical separation of the water from the steam. The Coal Calorimeter is of great value in Power Plants as it determines the calorific power of coal almost directly in B. T. U.

S & B Calorimeters are easily operated, requiring no special technical knowledge, and results are most satisfactory for practical problems.



Calorimeter

C. J. TAGLIABUE MFG. CO.

18 to 88 THIRTY-THIRD STREET, BROOKLYN, N. Y.

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CLEVELAND
SAN FRANCISCO

Manufacturers of Instruments for Indicating, Recording and Controlling Temperature and Pressure



Hohmann-type
Thermometer

MERCURIAL THERMOMETERS

Hohmann-type, as well as types of lower quality, in various sizes, forms and scale-ranges as required for the particular applications to

Stationary Power Plants

Marine Power Plants

Refrigeration Systems

Water Cooling and Distillation

Ventilating and Heating, etc.

AUTOMATIC CONTROLLERS

Of several types and various forms, according to requirements, for automatically maintaining—at exact point desired—either temperature or pressure when applied to

Condensers

Forced and Induced Draft

Feed Water Heaters

Systems

Hot Water Service Tanks

Water Purification

Stoker and Blower Systems

Condensing Systems, etc.

GAGES

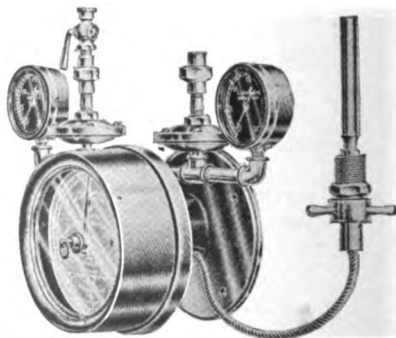
Mercurial, Water and Oil, of various types, for Vacuum and Pressure.

OIL TESTING INSTRUMENTS

Hydrometers, Viscosimeters, Flash and Burning Point Testers, Freezers, Gage and Wantage Rods, etc.

MISCELLANEOUS

Engineers' Testing Sets, Pyrometers, Barometers, Hygrometers, Hydrometers, etc.



"Perfect" type Automatic Temperature Controller

TAYLOR INSTRUMENT COMPANIES

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Manufacturers of a Complete Line of Instruments for the Indicating, Recording and Regulating of Temperature and Pressure



Tycos Recording Thermometer

TYCOS RECORDING THERMOMETERS give continuous records of temperature. Made in both self-contained and flexible tube form for all industrial applications. Range -40° to 1000° Fahr.



Tycos Temperature and Pressure Regulator

H & M TYCOS AUTOMATIC TEMPERATURE AND PRESSURE REGULATORS for processes requiring uniformity of Temperature or pressure conditions. "Type A" illustrated above has a separable sleeve. Regulator can be removed from tank without drawing off contents.



Tycos Pyrometer

TYCOS PYROMETERS
Base Metal -0 to 2200° F.
Rare Metal -0 to 3000° F.

VERY AND FOSTER RADIATION PYROMETERS
No upper limit of range.
All forms furnished in single or multiple outfits, Indicating or Recording.
All Tycos Recording Pyrometers furnish ink records on charts having Rectangular coordinates.



Tycos Pyrometer Switchboard

TYCOS ANEMOMETERS
For the registration of currents of air in velocity in Mines, Tunnels, Sewers, Ventilators, airways of Public Buildings, etc.

Tycos Anemometers run on jewelled bearings, are supplied with patent zero attachments and are fitted in leather carrying cases. Made in 3", 4" and 6" sizes.



Tycos Anemometer

If interested in Temperature Regulators, Pressure Regulators, Recording Thermometers, Angle and Straight Stem Thermometers, Engraved Stem Thermometers, Hydro-deiks and Hygrometers, Thermo-Electric and Radiation Pyrometers, our catalogues are indispensable—May we place them in your hands? Name type of instrument in which you are interested.



H & M Indicating Thermometer for Stack Temperatures

THWING INSTRUMENT COMPANY

436 N. 5TH St., PHILADELPHIA, PA.

59 Pearl St., NEW YORK

Transportation Bldg., CHICAGO

Manufacturers of Electrical Pyrometers, Electrical Thermometers, Milli-voltmeters



Thwing Pyrometer

THWING PYROMETERS

For stack temperatures, feed water, steam and furnace temperatures our Thermocouple Pyrometers are made with base metal or platinum thermocouples.

THWING ELECTRICAL THERMOMETERS

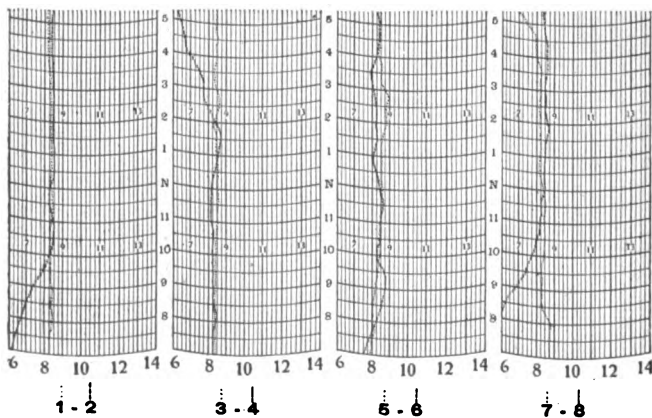
These depend upon the change of resistance of a nickel coil with temperature. They are adapted to measuring feed water and steam temperatures.

THWING RADIATION PYROMETERS

For furnace temperatures too high for thermocouples. Made in combination with thermocouples for tests on boilers. This will measure all temperatures from furnace to stack.

THWING RECORDERS

As many as 12 records, all clearly distinguishable, can be made with a single recorder on a straight chart.



THWING ELECTRICAL PYROMETER

NO. 1000000000

THWING INSTRUMENT CO. PHILA. PA.
PATENTED BY U.S. PAT. OFF. MAR. 12, 1907

COMPENSATED

All of our instruments are of the horizontal, double-pivot, high-resistance type and are compensated for variations in room temperature. Made in Fahrenheit or Centigrade graduations as preferred.

WESTON ELECTRICAL INSTRUMENT COMPANY

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Cincinnati

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Richmond
Pittsburgh
Florence, Berlin

Chicago
Detroit
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San Francisco
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Denver
Toronto
Winnipeg
Vancouver

Montreal
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Paris
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Manufacturers of Instruments for Every Field of Electrical Measurement

Weston

ELECTRICAL INDICATING INSTRUMENTS

An A. C. or D. C. Instrument for every purpose—laboratory, central station, or for any form of commercial electrical measurement or testing.



A. C. Switchboard
Wattmeter, Model 167

The Weston A. C. Switchboard Instruments are unrivalled with respect to mechanical and electrical design and workmanship and hence with respect to performance.

Competent Engineers know that these Weston instruments are the only types that perfectly meet the practical requirements of service, and they likewise know the initial cost is little if any more than the cost of inferior instruments, and that because of their continuous accuracy and serviceability these Weston Instruments are much more economical to adopt than instruments of any other make.

Model 1 Portable D. C. Voltmeters are guaranteed to an accuracy of $\frac{1}{10}$ of 1% (in terms of full scale length). They are dead-beat. The knife-edge pointer traveling over a mirror, readings may be made within $\frac{1}{10}$ of a division at any part of the hand-calibrated scale.

In external appearance they are very handsome. The metal case has an exceedingly durable royal copper finish. The base is of selected mahogany, highly polished.



Model 1

Weston A. C. Switchboard Instruments are fully described in Catalog 16. Model 1 and the various other D. C. Portable Instruments are described in Bulletin 501.

No matter what your requirements may be, state them and we will forward appropriate Bulletins.



AMERICAN APPARATUS CORP'N

Successors to Lenz & Naumann, Inc.

9-11 EAST 16TH ST., BETWEEN FIFTH AVENUE AND BROADWAY,
NEW YORK, N. Y.

**Manufacturers, Importers, Exporters and Dealers in Chemical, Biochemical,
Medical, Surgical and Physical Apparatus and Supplies—Laboratory Furniture**

Apparatus Made in America

THE LENZMANN-KOBER NEPHELOMETER AND COLORIMETER

A new and improved instrument for either Nephelometric or Colorimetric Determinations (description and price upon request).

THE RICHE ADIABATIC CALORIMETER

(Pamphlet on Calorimetry and the use and usefulness of this apparatus just issued.)
This is the original and only Vacuum Calorimeter on the market. Accuracy, speed and ease of operation are its features.

THE LENZMANN ELECTRIC INCUBATOR

Most reliable on the market.

THERMOMETERS

Precision Instruments, Beckmann Thermometers, all kinds of Chemical Thermometers, etc.

HYDROMETERS

Of all kinds and descriptions.

BAROMETERS

THE LENZMANN MICROMETER READING DEVICE

For Thermometers, Burettes, etc. *Simple, reliable, accurate.*

LENZMANN INSOL GLASSWARE of all descriptions is *the* best glass made in America, to replace the *German Glass*. Look for the "Lenzmann Insol" mark.
It is uniform in shape and thickness, correct in weight; acid and alkali resisting.

PORCELAIN WARE of all description:

Crucibles, Evaporating Dishes, Büchner Funnels, etc., etc.

FILTER PAPER, best grades, white and gray, all sizes.

BALANCES AND WEIGHTS

RUBBER GOODS FOR LABORATORY:

Pure Black Gum Rubber Tubing, Rubber Stoppers, etc., etc.

NITROMETERS

CHEMICAL HARDWARE: Supports, clamps for burettes, etc., fasteners, pinchcocks, etc., iron mortars, dishes, retorts.

LABORATORY CRUSHER

PETERSON'S LABORATORY FURNITURE; the best in the country; cabinets, tables, hoods, etc. Complete equipments arranged for.

VENTILATING BLOWERS

TIRRILL'S GASOLINE GAS MACHINES AND BURNERS

LENZMANN SPECIALTIES:

Our new *Chemist Apron* (at \$2.00 apiece) is recommended for the protection of the clothes.

THE LENZMANN FIELD COT is ideal, sanitary, used in the house, or camp, in the laboratory. It is a hospital utility; may be folded.

FIRST AID OUTFIT

The best, complete and most reasonable cabinet on the market (\$3.50).

All other requirements in our line are given careful attention.

PERMANENT EXHIBITION OF THE BEST AND FINEST PETERSON LABORATORY FURNITURE at our showrooms, 9-11 East 16th Street, New York, this Company being the sole Eastern Distributor of Leonard Peterson & Co., Inc., Chicago, Ill.

EIMER & AMEND

Established 1851

205-211 THIRD AVENUE, NEW YORK, N. Y.

Manufacturers and Furnishers of All Forms of Laboratory Apparatus

ASSAY APPARATUS

A full line of Crucibles, Crushers, Furnaces, Prospectors' Outfits, Pulverizers, etc.

BACTERIOLOGICAL APPARATUS

Including Bacteria and Blood Counting Apparatus, Centrifuges, Incubators and Sterilizers, Microscopes and Microtomes, Urinary Testing Apparatus, etc.

BALANCES

All kinds—Analytical, Assay and Pulp, Solution, Specific Gravity, special for rubber, etc.

CALORIMETERS

To test the heating value of coal, gas, oil, steam, etc.

ELECTRICALLY HEATED LABORATORY APPARATUS

Especially the following: Replaceable Unit Furnaces for temperatures to 2000° C., Hot Plates, Automatically Controlled Incubators and Ovens, also Baths, Distilling Apparatus, Extraction Apparatus, etc.

335

GAS TESTING APPARATUS

Orsat's and other forms.

HYDROMETERS

Beaumé, Specific Gravity, Brix, Twaddle, etc.

OIL TESTING APPARATUS

Flash Point Testers and Viscosimeters.

PYROMETERS

Electric Resistance, Optical, and Radiation, for every range of temperature, with automatic control device.

STEEL TESTING APPARATUS

Including the Fleming apparatus for carbon, the Wiborgh for sulphur, The Brinell Hardness Tester, the Wysor Specimen Polishing Apparatus, Metallographic Microscopes, etc.

Thermometers

Of varying range, scales, and degree of accuracy, some with Bureau of Standards certificate.

NEWMAN CLOCK COMPANY

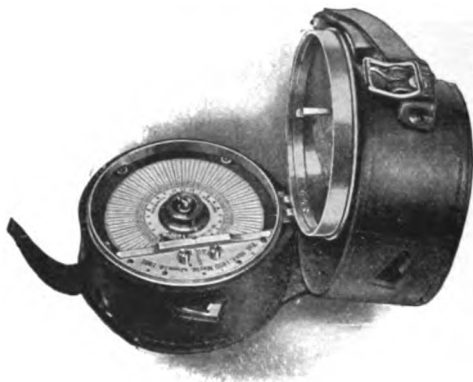
Established 1872

178 FULTON ST., NEW YORK

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Makers of Watchman's Clocks for Forty Years

NEWMAN GRILLE WATCH-CLOCKS



The Newman Clock Open in Grille Pouch

336

The Newman System of Time Recording equips the watchman with a portable watch-clock which must be carried in rotation on every hourly inspection round, to patrol stations, located at the important inspection points and each having a key, which when inserted and turned in the clock registers on a paper dial therein the distinctive mark of that station and the exact time at which the station was visited.

Advantages of the Newman Method of Registration: 1. Each key, when turned until it clicks, embosses upon the paper dial a distinctive character or figure, tamper-proof and different from that of every other key.

2. The Newman method is the only one in which there is *only one moving part*, the key itself, which does the registering.

3. The Newman key cannot be successfully duplicated except by us.

Simple design, high quality of movement, material and workmanship, reliability, durability and low maintenance expense. Newman Grille Clocks have no equal—and hence, cannot compete in first cost with made-to-sell-at-a-price product. *But* after several years' use, Newman Clocks *do* become the less expensive.

Approved by the National Fire Protection Association for use under the rules and requirements of the National Board of Fire Underwriters and by all Mutuels. Endorsed by the U. S. Government.

■ *Forty years' supremacy in our field make us the logical firm to consult about time-recording problems.*

SLOCUM, AVRAM & SLOCUM LABORATORIES, INC.

NEW YORK CITY, U. S. A.

Manufacturers of the Productograph



The Productograph

"An Instrument for Recording Efficiency of Machines"

The PRODUCTOGRAPH gives an absolute and correct record of lost time, productive working time, average speed and output, and it enables the Manager to put his hands on the weak links of his organization.

COMPONENT RECORDING FEATURES OF THE PRODUCTOGRAPH

- (1) Chart for recording total production, also productive and non-productive time.
- (2) Accumulator for accumulating actual productive and non-productive time.
- (3) Counter for reckoning total production.
- (4) Lamp for denoting whether or not machine is producing.

The Productograph proper and its accessories has the special advantage in that each accessory forms a unit in itself. This arrangement makes it possible to supply the instrument fully equipped or with any combination of recording features in order to meet the requirements of any type of plant.

Description: The PRODUCTOGRAPH is designed to graphically record a complete history of the operations of machinery in a plant irrespective of what is being manufactured. Special counter switches are installed on the different machines throughout the plant and from these switches wires are brought to the PRODUCTOGRAPH located in the central office.

With this arrangement the operation of each machine is recorded, thereby providing accurate and immediate information covering the production and time loss of any machine in the plant.

The Productograph has been used by the following industries within the past three years: Molding, printing, lithographing, cloth finishing, cloth printing, rope making, brick making, box making, screw making, textile manufacturing, shrapnel making and motor car manufacturing.

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It is therefore essential that engineers familiarize themselves with this instrument, so that they may intelligently recommend its use whenever it can be advantageously used.

Irrespective of the nature of the requirements which may be desirable for any class of manufacturing plant, the PRODUCTOGRAPH is capable of executing the demands.



JAMES G. BIDDLE

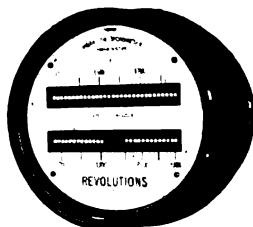
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Industrial and Scientific Instruments

FRAHM VIBRATING-REED TACHOMETERS

The Frahm Tachometer is an instrument for measuring revolutions per minute, which is always "on the job;" silently, continuously, accurately indicating speeds of the machine to which it is attached.

This remarkable achievement in tachometer construction results from a very simple application of the well-known principle of resonance. A classic illustration of this principle is to be found in two tuning-forks, each one of which develops the same number of vibrations. The prime-mover (or machine) to which a Frahm Tachometer is attached, corresponds to the first tuning-fork, and the instrument itself corresponds to the second one. Because it is practically impossible to perfectly balance any machine which contains rotating parts, each revolution produces a distinct impulse. For example, if a dynamo runs at 1000 R. P. M. there will be 1000 separate impulses per minute. Then if the Frahm Tachometer is calibrated properly, it will "respond"—just as the second tuning-fork does—and correctly indicate the speed. The practical application of this principle to industrial instruments, by Dr. Frahm, has required brilliant development work.



Frahm Tachometer with Two Rows of Reeds

Special Characteristics of Frahm Vibrating-Reed Tachometers.

Rugged Construction: There are no complex interior parts—such as delicate springs, jeweled bearings, pivots, pointer attachments, centrifugal weights, magnets and connecting wires. Practically nothing except a set of steel reeds, suitably mounted.

Simplicity of Mounting: No belt, gears, couplings or electrical connections are required—as it is only necessary to screw the Tachometer to a convenient part of the machine under test.

Permanent Accuracy: If accurate when installed—and that is merely a detail of manufacture—the instrument continues to be correct over long periods of constant duty; because the working parts do not change perceptibly with time.

Small Up-Keep Cost: Except in the case of an accident, a Frahm Tachometer will indicate speeds, year after year—twenty-four hours per day—without giving trouble of any kind. The instruments which come back to us for repairs, represent so small a proposition of the total number in use as to be quite negligible.

Frahm Tachometers are best suited for indicating speeds between 900 and 8000 R. P. M. For service outside these limits, a special actuating device must be used. After being thoroughly tried out under long-continued service conditions, these unique tachometers are being used by all builders of steam turbines. In many cases they are included as part of standard equipment—and in others are specified by purchasing engineers. Their field of greatest usefulness includes steam turbines, centrifugal pumps, centrifuges, turbo-blowers, dynamos, motors and all other machines that run at speeds between the limits above specified.

For full description and Price-List consult Catalog 855, free on request.

OTHER BIDDLE SPECIALTIES

Jagabi Electro-Magnetic Tachometers: Stationary speed-indicators of high accuracy and great durability; specially suited to speeds below 1000 R. P. M.

Jagabi Hand Tachometers, which operate on the centrifugal principle.

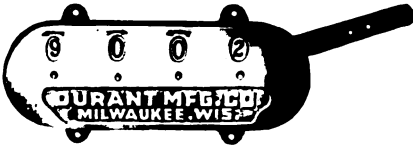
The Jagabi Hand Tachoscope, for accurate speed testing. Consists of an exceptionally high-class revolution (speed) counter, combined with a non-magnetic Swiss stop-watch of superior quality.

Also Megger Testing Sets and Bridge Meggers; Evershed Low Range Ducters; Siemens & Halske Precision Laboratory and Portable Voltmeters, Ammeters, Wattmeters, Shunts, Multipliers and Transformers; Hartmann & Braun High Frequency Ammeters and Wattmeters; "S-H" Standardizing Sets; Frahm Vibrating-reed Frequency Meters; Wolff and Tinsley Potentiometers; Laboratory Rheostats.

DURANT MANUFACTURING CO.

MILWAUKEE, WIS.

Manufacturers of Automatic Counters

The Productimeter**MODEL A**

A strong durable ratchet counter easily reset, adapted to stamping presses, conveyors and other severe uses. Also supplied with alarm bell for special applications.

Style	No. of Figures	Counting up to	Size Inches	Weight Pounds	PRICE, EACH	
					Plain	With Guard and Lock
4A-1	4	9999	7 x 2 1/4 x 1 3/4	3	\$ 8.50	\$10.50
5A-1	5	99999	8 1/2 x 2 3/4 x 1 3/4	3 1/2	10.00	12.00
6A-1	6	999999	10 x 2 1/2 x 1 3/4	4	12.00	14.00

MODEL B

A compact, full-g geared, dependable counter with outside reset. Brackets are arranged for securing to horizontal or vertical surfaces. Lever can be set at any position.



Type	Size Inches	Weight Pounds	PRICE	
			Five-fig.	Six-fig.
Standard with outside reset.....	3 3/4 x 2 3/4 x 2 1/8	2 1/2	\$10.00	\$12.00
Standard with outside reset and lock.....	3 3/4 x 2 3/4 x 2 1/8	2 1/2	10.50	12.50
Rotary drive outside reset.....	3 3/4 x 2 3/4 x 2 1/8	2 1/2	10.00	12.00
Lineal measure attachment.....	.....	...	20.00	...

**MODEL C**

Designed for unusually severe usage. Absolutely rust proof. Particularly adapted for use on engines, compressors, scales, coal handling machinery, etc.

Type	Size Inches	Weight Pounds	Four-fig.	PRICE	
				Five-fig.	Six-fig.
With outside reset.....	4 1/2 x 3 x 2	3 1/2	\$16.00	\$18.00	\$20.00
Nonresetting.....	4 1/2 x 3 x 2	3 1/2	12.00	14.00	16.00

MODEL D

A small compact counter with a sturdy, accurate driving mechanism, suitable for a wide variety of uses.



Type	Size Inches	Weight Ounces	PRICE	
			Four-fig.	Five-fig.
Standard with outside reset.....	2 x 1 3/4 x 1 1/4	8	\$8.00	\$ 9.00
Rotary drive with outside reset.....	2 3/4 x 2 x 1 1/4	14	9.60	10.80
Rotary drive nonresetting.....	.....	..	8.00	9.00

All prices subject to our regular discounts furnished upon request.

The Productimeter is made in many different styles and sizes. If none of the models shown meet your requirements, write for catalog No. 10 describing our complete line.

THE C. J. ROOT COMPANY

150 BRIDGE ST., BRISTOL, CONN.

Manufacturers of Automatic Counters, Hinges, Metal Stampings, etc.

ROOT AUTOMATIC COUNTERS



"Bristol" Counter

No.	Size Ins.	Ship. Wt. Lbs.	List Price
4	6½ x 2½ x 1½	3½	\$4.50
5	8 x 2½ x 1½	3½	5.00
6	9½ x 2½ x 1½	4½	6.00



"Bristol" Counter with Lock Bar (Open)

No.	Size Ins.	Ship. Wt. Lbs.	List Price
04	6½ x 2½ x 1½	3½	\$5.40
05	8 x 2½ x 1½	3½	6.00
06	9½ x 2½ x 1½	4½	7.00

Finish: Nickel Plated, Black Enameled, or Copper Oxidized.
Number of Counter corresponds with number of figures.



"Elm City" Counter

No.	Size Ins.	Ship. Wt. Oz.	List Price
12	3½ x 1½ x ¾	12	\$3.20
13	4 x 1½ x ¾	15	4.10
14	4½ x 1½ x ¾	18	5.20
15	5½ x 1½ x ¾	21	6.00
16	6½ x 1½ x ¾	24	6.80

Finish: Polished Brass, Whitened Dials.



"Elm City" Set-Back Counter

No.	Size Ins.	Ship. Wt. Oz.	List Price
113	4 x 1½ x ¾	15	\$5.20
114	4½ x 1½ x ¾	18	6.00
115	5½ x 1½ x ¾	21	7.00
116	6½ x 1½ x ¾	24	8.00

We also make the "Elm City" WITH
LOCK BAR. Specifications same as above.

Number of Counter corresponds with number of figures.



No. 96 "Ro-co" Counter
Operated by Rotating Shaft, No Springs

No.	Size Ins.	Ship. Wt. Lbs.	List Price
95 (5 Fig.)	8 x 2½ x 1½	4	\$6.00
96 (6 Fig.)	9½ x 2½ x 1½	5	7.00

Black Enamel Finish.



No. 26 "Ro-co" Counter
Reciprocating Type

No. 26 (6 Fig.).	Size, 6½ x 1½ x 1½ ins.	Ship. Wt., 30 oz.	List Price, \$8.00.
------------------	-------------------------	-------------------	---------------------

In Nickel Plated or Copper Oxidized Finish.

"Ro-co" Counter, Closed Case

No. 54 (4 Fig.)	Size, 4½ x 1½ x 1½ ins.	List Price, \$4.00
" 55 (5 ")	" 5½ x 1½ x 1½ "	" " 4.60
" 56 (6 ")	" 6½ x 1½ x 1½ "	" " 5.00

Made entirely without springs and has a nickel plated closed case.

PLEASE WRITE FOR
CATALOGUE M FOR
COUNTERS

These counters can be
shipped by Parcel Post at
small expense.



Catalogue W for
Hinges and
Stampings.

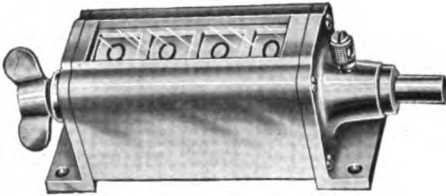


THE VEEDER MANUFACTURING CO.

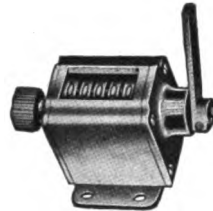
HARTFORD, CONN.

Makers of Cyclometers, Odometers, Tachometers, Tachodometers, Counters, Speed Counters and Fine Die Castings

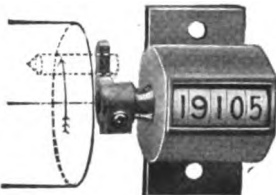
VEEDER COUNTERS



Set Back Counter



Small Set Back Counter



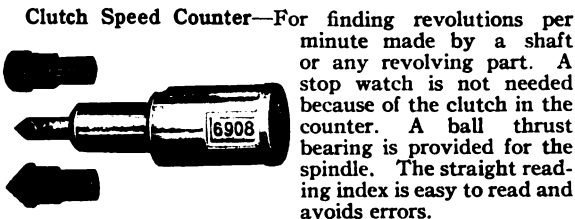
Revolution Counter

Veeder products include a wide variety of counting devices for practically every purpose. The Set Back Counters illustrated here, are especially designed for use on all kinds of machinery where it is desired to keep accurate record of the amount of work done by the machine or operator.

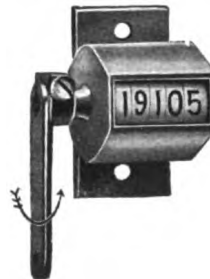
These instruments are so constructed as to operate with the greatest ease, thereby using practically no power. The quality of material and workmanship is so high that they will withstand long arduous use. No one has ever questioned the instrumental excellence or the durability of Veeder Counters.



Hand Tally Counter



Clutch Speed Counter—For finding revolutions per minute made by a shaft or any revolving part. A stop watch is not needed because of the clutch in the counter. A ball thrust bearing is provided for the spindle. The straight reading index is easy to read and avoids errors.



Rotary Ratchet Counter

We make counters for almost every conceivable purpose:

CYCLOMETERS

For Bicycles and Motorcycles, to Register the Distance Traveled.

ODOMETERS

For Automobiles and Horse-Drawn Vehicles, to Measure Distance Traveled.

COUNTERS

To Register Revolutions or Reciprocating Movements. Twenty-five Styles.

SPEED COUNTERS

For Finding the Revolutions per Minute Made by a Shaft or Any Other Revolving Part.

TACHODOMETERS

To Indicate the Speed and Record the Distance Traveled, both Trip and Total.

For Use on Automobiles, Locomotives and Electric Railway Cars.

TACHOMETERS

To Indicate Speed in Revolutions per Minute of Shafts, Generators, Motors, etc.

FINE DIE CASTINGS

Where Large Numbers of Absolutely Uniform Small Parts Are Required.

Every mechanical engineer should have a copy of our complete catalogue, which describes more than 25 styles of counters. It will be supplied free upon receipt of application.



DATA SECTION

**Mechanical Engineering
Data**

343

Pages 346-384

On the following pages are engineering data selected from the Transactions, Volume 37, 1915, and from The Journal, 1915, of the American Society of Mechanical Engineers.

The material from the Transactions includes original data derived by the authors of papers presented to the Society and embodied in those papers.

The data from The Journal are taken from the Engineering Survey Section, which includes abstracts from domestic and foreign periodicals and from publications of foreign societies; and the source of information is given in each instance.

With but possibly two or three exceptions, these data have not as yet appeared in any engineering handbook.

INDEX TO ENGINEERING DATA

Aluminum, Properties at Higher Temperatures.....	346
Automobiles, Gasoline, Formula for Comparison of Performances of.....	380
Bearings, Journal, Laws of Lubrication of.....	353
Benzol, Combustion of, in Internal-Combustion Engines.....	369
Belt Conveyors, Chart for Calculations on.....	376
Leather, Effect of Relative Humidity on.....	380
Boilers, Accidents to, Data on.....	362
Cornish, Quality of Steam vs. Load.....	367
Firetube, Eddy Rings in.....	359
Brass, Properties at Higher Temperatures.....	346
Brick, Air Permeability of.....	347
Calcium Chloride Solutions, Properties of.....	372
Capillary Orifices, Efflux of Drops from.....	357
Cast Iron, Bending Elasticity of.....	351
Elastic Behavior under Combined Stresses.....	349
Centrifugal Pumps, Characteristic Curves of.....	371
Disk Friction in.....	372
Chimneys, Formulae for.....	358
Coke, Absorption of Moisture by Submerged.....	358
Combined Stresses, Elastic Behavior of Cast Iron under.....	349
Combustion Temperatures of Gases.....	369
Concrete, Gravel, Permeability of.....	348
Percolation of Water through Joints of.....	356
Conveyor Belt Calculating Chart.....	376
Cooling Towers, Forced-Draft, Tests of.....	368
Crane Wheels, Chilled-Iron, Safe Strength of.....	376
Draft, Chimney, Formula for.....	357
Flow of Sand and Water through Spigots.....	358
of Viscous Fluids through Smooth Circular Pipes.....	356
Gases, Combustion and Explosion Temperatures of.....	369
Gears, Stub-tooth C. I. Cut, Breaking Strength of.....	378
Heat Treatment of Steels, Effects on Properties.....	346
Heating and Ventilating, Dimensioning Pipes for.....	375
Hollow Structural Members, Lateral Flexure of.....	350
Hysteresis in Solid Bodies, Elastic.....	351
Ice, Specific Heat and Heat of Fusion of.....	374
Impact Tests, Notched-Bar, Notes on.....	350
Internal-Combustion Engines, Combustion of Benzol in.....	369
Iron, Cast (See Cast Iron).....	
Wrought, Properties at Higher Temperatures.....	346
Journal Bearings, Lubrication of (Laws of).....	353
Laps and Lapping.....	379
Leather Belts, Effect of Relative Humidity on.....	380
Locomotive Coupling Rod, Stresses in.....	355
Lubrication of Journal Bearings, Laws of.....	353
Mean Temperature Differences, Chart for Determining.....	360
Metals, Properties at Higher Temperatures.....	346
Oil Engines, Hot Bulbs for, Proportions of.....	370
Orifices, Capillary, Efflux of Drops from.....	357
Pipe Coverings, Steam, Data on.....	359, 383
Pipes, Flow of Viscous Fluids through.....	356
for Heating and Ventilating Installations, Dimensions of.....	375
Pneumatic Transmission Tubes, Air Required by and Leakage in.....	374
Porcelain, Physical Properties of.....	347
Power Plant Testing, Standards Employed in.....	363
Pumps (See Centrifugal Pumps and Turbine Pumps).....	
Rolling of Hard Body over Plastic Surface, Resistance to.....	381
Safety-Valve Springs, Stresses in.....	367
Sand and Water, Flow through Spigots.....	357
Sandstone, Air Permeability of.....	347
Shaft, Diesel Engine, Torsional Oscillations of.....	354
Spigots, Flow of Sand and Water through.....	357
Springs, Safety-Valve, Stresses in.....	367
Standards Relating to Capacity, Efficiency and Economy of Power Plant Apparatus.....	363, 367
Steam Engines, Higher Steam Pressures for.....	362
Pipe Coverings, Data on.....	359, 383
Turbines, Higher Steam Pressures for.....	362
Steel, Cast, Properties at Higher Temperatures.....	346
Carbon, Life under Repeated Bending Stresses.....	352
Nickel, Carbon and Manganese, Properties before and after Heat Treatment.....	346
Stoneware, Physical Properties of.....	347
Stresses in Struts and Tie Rods in Motion.....	355
Teak Wood, Mechanical Properties of.....	349
Telegraph Poles, Deterioration and Life of.....	348
Temperature Differences, Mean, Chart for Determining.....	360
Torsional Oscillations of a Diesel Engine Shaft.....	354
Traction Resistance of Vehicles.....	381
Turbine Pumps, Disk Friction in.....	372
Units Employed in Power Plant Testing Calculations.....	363-367
Vehicles, Resistance to Rolling of.....	381
Ventilating, Pipes for, Dimensioning of.....	375
Viscous Fluids, Flow through Pipes.....	356
Water, Percolation and Upward Pressure of.....	356

PROPERTIES OF METALS AT HIGHER TEMPERATURES

(From data of tests made in Germany)

Aluminum. With increasing temperature the hardness and strength steadily decrease, while the ductility and malleability steadily increase. At 500 to 600 deg. cent. the latter was so great that aluminum, like lead, could be drawn to a fine point.

Wrought Iron. While the iron tested was not chemically pure, it was of very low carbon content (the chemical analysis indicated 0.06 per cent carbon, 0.47 manganese, 0.037 phosphorus, and traces of silicon). At the so-called blue heat (about 250 to 300 deg.) there is a higher strength with greater brittleness. At 600 deg. the ductility is at its maximum.

Cast Steel (Virtually hard wrought iron close to the steel limit.). As in the case of wrought iron, the maximum of strength and brittleness was reached at about 250 deg. At about 600 deg., likewise, the ductility is at its maximum.

Copper. A decrease of strength with increase of temperature is continuous until close to the melting point. The contraction of area materially decreases between 200 and 600 deg., increases at about 800 deg., and starts to decrease again above that temperature.

Brass. Strength and ductility decrease as a rule with increase of temperature.

[*Journal*, October, 1915, p. 604][Source: P. Ludwik, *Zeit. d. Ver. deutsch. Ing.*, vol. 59 (1915), p. 657]

PROPERTIES OF NICKEL, CARBON AND MANGANESE STEEL BEFORE AND AFTER HEAT TREATMENT

The following equations represent fairly well the average values of the elastic limits, maximum strengths, reductions in area and elongations of the three steels.

E = elastic limit in pounds per square inch.

M = maximum stress in pounds per square inch.

r = reduction in area in per cent.

e = elongation in per cent.

T = temperature of draw in degrees fahrenheit.

For manganese steel

$$E = 284,000 - 163 T \qquad r = -19 + .068 T$$

$$M = 288,000 - 159 T \qquad e = -10 + .028 T$$

For nickel steel

$$E = 302,000 - 183 T \qquad r = 40 + .024 T$$

$$M = 314,000 - 188 T \qquad e = 3.5 + .018 T$$

For carbon steel

$$E = 134,000 - 66 T \qquad r = -5.8 + .063 T$$

$$M = 170,000 - 77 T \qquad e = -3 + .026 T$$

For a heat-treated $1\frac{1}{2}$ per cent manganese steel the manganese in excess of that contained in a nickel steel of a corresponding carbon content (about 0.34 per cent) exerts a strengthening effect equivalent to about three times the same amount of nickel.

An untreated steel containing about $1\frac{1}{2}$ per cent manganese is fully as tough, and is stronger than a nickel steel of about $3\frac{1}{4}$ per cent nickel.

[Robert R. Abbott. *Trans.*, vol. 37, p. 39]

AIR PERMEABILITY OF BUILDING MATERIALS

If it be assumed that the volume of air Q flowing in a unit of time through an area F of stone is inversely proportional to its thickness d , and directly proportional to the gage pressure p , then the volume of air flowing through the stone is defined by the equation:

$$Q = c p F$$

where c indicates the volume which will flow per hour through 1 sq. m. of stone surface 1 m. thick at the gage pressure of 1 mm. of water.

The following average values of c have been obtained from tests:

Sandstone.....	997
Chalky sandstone.....	14.4
Perforated brick.....	5.83
Hand-made brick (hard-burned).....	226
Machine-made brick.....	1.42

It has been found that the coefficient c is not constant, but increases as the pressure decreases, this increase being materially greater with porous than with tough material.

[*Journal*, August, 1915, p. 477]

[Source: *Gesundheits-Ingenieur*, vol. 38 (1915), p. 265]

347

PHYSICAL PROPERTIES OF STONEWARE AND PORCELAIN

The modulus of elasticity of stoneware and porcelain is practically the same in tension and compression. Its value may be obtained conveniently by a bending test.

The modulus of elasticity of porcelain is about 10,000,000. The modulus of stoneware ranges from 6,000,000 to 9,000,000, depending on the material.

The compressive strength of porcelain and high-grade stoneware in a column 16 in. long and 1 in. in diameter is about 20,000 lb. per sq. in. The stress-strain diagram is practically straight up to 7000 lb. per sq. in.

The tensile strength of porcelain is above 3000 lb. per sq. in. The diagram is a straight line up to this stress. The tensile strength of stoneware ranges from above 1100 to above 2200 lb. per sq. in. The stoneware of the greater modulus has the greater strength.

[J. E. Boyd. *Trans.*, vol. 37, p. 795]

PERMEABILITY OF GRAVEL CONCRETE

From data of tests conducted at the University of Wisconsin the following conclusions are drawn:

In properly made mixes of 1 : 7 proportions or richer, the rate of flow for a 50-hour period is less than 0.0001 gal. per sq. ft. per hour under a pressure of 40 lb. per sq. in.

If proportions must be selected arbitrarily, a 1 : 1.5 : 3 mix by volume is very impervious.

Although the use of a wet consistency does not materially effect the imperviousness of very rich mixes such as 1 : 1.5 : 3, it greatly increases the flow through a lean mix.

For a mixer running at 30 r.p.m., a period of 1½ to 2 minutes is required to secure thorough mixing of a 1 : 9 concrete, whereas for a rich 1 : 1.5 : 3 mix a 1-min. period appears to be sufficient.

The imperviousness of the concrete increases rapidly with the age of the specimens for the first month; thereafter a change was not marked.

It appears probable that the permeability of lean concrete in a direction normal to the pouring is greater than in the direction of pouring.

[*Journal, January, 1915, p. 60*]

[Source: *Journal, Ohio Society of Mechanical, Electrical and Steam Engineers, November, 1914*]

LAWS OF DETERIORATION OF TELEGRAPH POLES

For predetermining the life of impregnated poles the following equation, based on the laws of probability, may be used:

$$y = \frac{0.564^h}{e^{h^2} x^2}$$

In which x and y are, as usual, unknown quantities, e is the base of natural logarithms, and h a constant which may be denoted as a parameter and has a different value for each average period of life of the pole; for any average life of pole,

$$h = \frac{0.477 \times 5}{\text{average life}}$$

Thus, for the average life of 20 years, which is about what is obtained from kyanization and poles impregnated in a proper manner with tar oil, the curve of probable exchange of poles has the following shape:

$$y = \frac{0.564 \times 0.096}{e^{0.096^2} \times x^2} = \frac{0.0541}{e^{0.00012} \times x^2}$$

The accompanying table gives the average life of telegraph poles of various woods, compiled by the German postal authorities from data published by telegraph administrations of various countries.

MECHANICAL ENGINEERING DATA

AVERAGE LIFE OF TELEGRAPH POLES OF VARIOUS WOODS (UNTREATED).

	Years
Oak (Hungarian).....	7
Cypress.....	8 to 10
Larch (Austrian).....	10
Chestnut.....	10
Cedar (N. American).....	15

[*Journal*, November, 1915, p. 653]

[Source: *Elektrotechnische Zeitschrift*, vol. 36 (1915), p. 449]

MECHANICAL PROPERTIES OF TEAK WOOD

Java teak is stronger in compression than Indian teak and can stand stresses as high as 479 to 498 kg. per sq. cm.

Artificial drying has shown that a loss of weight for a period of drying of one day amounted to 2.3 per cent. For the next two or three series of two to three days each this loss varied from 2.0 to 2.8 per cent, and in the last ten days of the test only 1.2 per cent—the total loss in weight after forty days being 15.7 per cent.

As regards change in the volume, none was found in the length (in the direction of fiber but parallel to the year rings), but 1.4 per cent was found in the width and 1.1 per cent in thickness (radial to the year rings).

[*Journal*, May, 1915, p. 289]

[Source: *Glaser's Annalen für Gewerbe und Bauwesen*, vol. 76 (1915), p. 68]

349

ELASTIC BEHAVIOR OF CAST IRON UNDER COMBINED BENDING AND TORSIONAL STRESSES

Tests made at the laboratory of the College of Engineering of the Imperial University of Kyoto, Japan, have led to the adoption of the following equation representing the law of combined strength of cast iron:

$$M_o = (1 - A)M + A\sqrt{M^2 + T^2}$$

where M is the moment of bending, T the torsional moment, A a constant and M_o the equivalent bending moment; that is, $M_o = \frac{\pi}{32} d^3 K$, if d is the diameter of the rod subjected to the combined action and K the bending strength (elastic bending strength for a ductile material).

[*Journal*, June, 1915, p. 347]

[Source: *Memoirs*, College of Engineering, Kyoto, Japan, vol. 1 (1915)]

LATERAL FLEXURE OF HOLLOW STRUCTURAL MEMBERS

For the calculation of metal or reinforced-concrete constructions constituted by two parallel members united at equal intervals by cross-pieces so as to form a rigid structure, the following formula applies:

$$P_l = \frac{\pi^2 EI}{L^2} \left[\frac{\alpha}{1 + \frac{1 + 2I_A}{2.5n^2 I_A} \cdot \alpha} \right]$$

where P_l is the critical stress, E is the modulus of elasticity of the material, L the length of flexure, I_A the moment of inertia of one of the parallel members, I the moment of inertia of the entire element, that is, the two parallel members, $n = L/f$, where f is the length between two consecutive cross-pieces. α is a variable coefficient which is a function of the number of sections n , and has the following values:

$n =$	2	3	4	5	6	7	8	∞
$\alpha =$	1.62	1.22	1.11	1.07	1.05	1.04	1.03	1.00

For the coefficient of permissible work the following rule is recommended: In a piece under compression, consisting of two parallel members connected into a rigid structure by cross-pieces located at equal distances from one another, the coefficient of permissible work is equal to the coefficient for a solid prism of the same moment of inertia multiplied by a coefficient k , less than unity, and given by the formula

$$k = \frac{\alpha}{1 + \frac{I + 2I_A}{2.5n^2 I_A} \cdot \alpha}$$

[*Journal*, May, 1915, p. 287]

[Source: *Le Génie Civil*, vol. 66 (1915), p. 150]

NOTCHED-BAR IMPACT TESTS AND THE LAW OF SIMILARITY

Experiments made by R. Stribeck have indicated that when two bars were broken having, respectively, square sections of 3 cm. and 1 cm. on each side of section and diameters of the notch 6 mm. and 2 mm., a larger amount of energy was necessary to break the smaller bar than accorded with the law of proportionality. It was found also that the assumption of the International Association for Testing Materials that the 3-cm. and 1-cm. proportional bars have the same values for the specific energy of blow, is not even approximately correct. Further, it was found that the energies of blow *do not* vary as the cubes of the dimensions of the bars.

[*Journal*, March, 1915, p. 183]

[Source: *Zeit. d. Ver. deutsch. Ing.*, vol. 59 (1915), p. 57]

ELASTIC HYSTERESIS IN SOLID BODIES

It has been found recently that the proportionality between deformation and force applied as expressed by Hooke's Law does not always hold good, and the elastic deformation is not always reversible.

In Fig. 1, OA is the virgin line of the material newly stressed in tension. ABC shows its contraction down to the state C , and CDA the more recent expansion

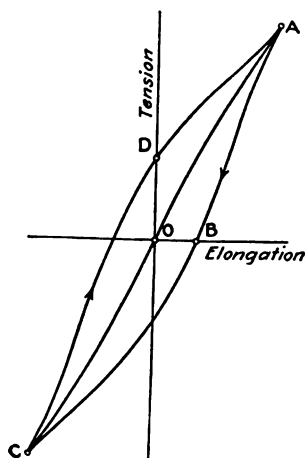


FIG. 1 HYSTERESIS LOOP OF ELASTIC DEFORMATION

351

into the state A . The curve becomes a closed one when A and C are symmetrically located with respect to the O point, and in further cycles of the process practically the same path is repeated over and over again in the direction of the arrow.

The area of the hysteresis loop in a circular process is numerically equal to the work lost per unit of volume, such work having been partly transformed into heat and partly used up in the displacement of the molecules, and has thus possibly led to the rise of fatigue in the material.

[*Journal*, February, 1915, p. 115]

[Source: *Zeit. d. Ver. deutsch. Ing.*, vol. 58 (1914), p. 1600]

BENDING ELASTICITY OF CAST IRON

From tests carried out at the University of Fukuoka, Japan, it has been found that in the case of cast iron both the total and permanent elongation occurring at a certain stage of loading materially increase with the number of repetitions, while the elastic elongation appears to have a much more regular behavior.

From the experimental data partly reported in the accompanying tables, the following equations are obtained:

For tensile strength,

$$\epsilon = \frac{1}{2,690,700} \sigma^{1.193}$$

For compressive strength,

$$\epsilon = \frac{1}{1,320,800} \sigma^{1.049}$$

where σ = unit load in kg. per sq. cm., and ϵ = elongation.

The permanent elongation observed in the extreme fibers and under tension during the bending test was considerably slighter than during the tension test.

Further, the bending tests have shown that the ratio of the permissible bending stress to the permissible stress in tension is different from that of the strength in bending to strength in tension.

VALUES OF σ AND ϵ

From Four Tension Tests			From Four Compression Tests		
σ kg/cm ²	ϵ (observed) 10 ⁻⁴	ϵ (calculated) 10 ⁻⁴	σ kg/cm ²	ϵ (observed) 10 ⁻⁴	ϵ (calculated) 10 ⁻⁴
95.5	0.900	0.856	97.3	0.938	0.922
191.0	1.900	1.956	194.6	1.883	1.908
286.5	3.029	3.173	291.9	2.878	2.919
382.0	4.308	4.473	389.2	3.918	3.947
477.5	5.755	5.837	486.5	4.998	4.988
573.0	7.399	7.255	583.8	6.028	6.039
668.5	9.229	8.719	681.1	7.148	7.100
.....	.....	.....	778.4	8.213	8.167
.....	.....	.....	875.7	9.283	9.241

[*Journal*, May, 1915, p. 291]

[Source: *Memoirs of the College of Engineering*, Kyushu Imperial University, Fukuoka, Japan, vol. 1, p. 111, 1915]

LIFE OF CARBON STEEL UNDER REPEATED BENDING STRESSES

Tests made by bending back and forth steel bars of varying carbon content have shown that at any stress the higher carbon steels withstood the repeated stresses better than the lower carbon steels, and that there is no natural elastic limit at stresses below which a steel will have infinite life against repetitions of load.

[*Journal*, April, 1915, p. 237]

[Source: *Journal*, Engineers' Society of Western Pennsylvania, November, 1914]

LAWS OF LUBRICATION OF JOURNAL BEARINGS

The shortest permissible length (l_0) of a bearing may be calculated from the equation

$$l_0 = \frac{L}{D} \cdot \frac{1}{p_0} \quad [1]$$

while the power dissipated in this bearing at a speed of n revolutions per unit time will be

$$P = \pi D n L f \quad [2]$$

Equations [1] and [2] are purely formal and their practical use demands a knowledge of some relation

$$f = \varphi(p, n, D, l, \text{etc.}) \quad [3]$$

between the coefficient of friction and all the physical quantities governing the action of lubrication; together with some relation

$$p_0 = \psi(n, D, l, \text{etc.}) \quad [4]$$

between carrying power and the factors upon which it may depend. In these equations L is the load on the bearing perpendicular to its axis; p is the bearing pressure defined by the equation $p = L/lD$, in which equation l is the length of the bearing and D the diameter of the journal; p_0 is the greatest permissible bearing pressure. For all cylindrical bearings which are free from cavitation or end effects; centrally or uniformly loaded; and which have bearing surfaces that are geometrically similar in cross-section (though not necessarily having the same relative clearance),

$$f = \varphi_1 \left(\frac{\mu n}{p}, \frac{D^3 n}{Q}, \frac{c}{D} \right) \quad [5]$$

and

$$p_0 = \mu n \cdot \theta_1 \left[\left(\frac{x}{c} \right)_0, \frac{D^3 n}{Q}, \frac{c}{D} \right] \quad [6]$$

For all bearings in which S , $\frac{l}{D}$, and r are the same, even though not cylindrical and centrally loaded, and in which there is no appreciable thrust due to forced lubrication, Q cannot enter the equations; hence the whole term $\frac{D^3 n}{Q}$ drops out and the equations reduce to

$$f = \varphi_2 \left(\frac{\mu n}{p}, \frac{c}{D} \right) \quad [7]$$

and

$$p_0 = \mu n \cdot \theta_2 \left[\left(\frac{x}{c} \right)_0, \frac{c}{D} \right] \quad [8]$$

In the foregoing the fraction x/c may be called the relative film thickness; c is the radial clearance or mean difference in radii between journal and the bear-

ing, while x denotes the film thickness or thickness of the film of lubricant at the point of nearest approach; μ is the viscosity of the lubricant, and f the line of action of the load defined by some length ratio such as the ratio of its distance from the middle point of the bearing to the diameter. Q is the quantity of lubricant flowing through bearing in unit time.

For bearings free from cavitation (S , or ratio of volume of lubricant in bearing to whole volume of clearance space = 1), similarly loaded and geometrically similar throughout (r , $\frac{l}{D}$, and $\frac{c}{D}$ constant),

$$f = \varphi_3 \left(\frac{\mu n}{p}, \frac{D^3 n}{Q} \right) \quad [9]$$

and

$$p_0 = \mu n \theta_3 \left[\left(\frac{x}{c} \right)_0, \frac{D^3 n}{Q} \right] \quad [10]$$

The laws of lubrication for all such bearings of whatever size can be established experimentally by varying the two quantities $\frac{\mu n}{p}$ and $\frac{D^3 n}{Q}$; and this can be done on a single bearing.

[*M. D. Hersey. Trans., vol. 37, p. 167*]

TORSIONAL OSCILLATIONS OF A DIESEL ENGINE SHAFT

The following two equations fully determine the behavior of a shaft with a fairly large number of masses of which the moments of inertia about the axis of the shaft are indicated by J_1, J_2, \dots, J_n .

$$\begin{vmatrix} K_{11} + K_{12} - \alpha^2 & -K_{22} & 0 \\ -K_{12} & K_{22} + K_{23} - \alpha^2 & -K_{33} \\ 0 & -K_{23} & K_{33} + K_{34} - \alpha^2 \\ 0 & 0 & -K_{34} \\ & 0 & 0 & 0 \\ & 0 & 0 & 0 \\ & -K_{44} & 0 & 0 \\ & K_{44} + K_{45} - \alpha^2 & -K_{55} & 0 \end{vmatrix} = 0, \dots \quad [1]$$

$$\psi_i = \sum C_K \gamma_{Ki} \sin (\alpha_K t - \delta_K)$$

$$[i = 1, 2, \dots, n - 1; K = 1, 2, \dots, n - 1]$$

where

$$\frac{C_1}{J_1} = K_{11}; \frac{C_2}{J_2} = K_{12}; \frac{C_3}{J_2} = K_{22}, \text{ etc.}$$

γ with its subscripts refers to constants depending for their magnitudes on the constants of the shaft and masses held on it. The difference of angles $\phi_2'' - \phi_1'' = \psi_1''$, and $\alpha^2 = \frac{-\psi_1''}{\psi_1}$. δ is the phase displacement.

[1] is an equation of the $(n - 1)$ th power for the $(n - 1)$ values of α^2 which can be solved by any known analytical or graphical methods. When forced oscillations arise, one may expect as many resonances as there are values of α^2 (where α represents the masses of the cranked portions of the shaft and can be found from equation [I]).

Actually, because of the damping of oscillations, the greatest deflection will occur with the smallest α , and even before that the deflections will become excessively large. Further, in order to avoid excessive vibrations, it is necessary to have the smallest periods of free oscillations considerably greater than those of the forced oscillations.

Resonance is likely to occur only with moments of the second or fourth order.

[*Journal, July, 1915, p. 406*]

[Source: *Dingler's Polytechnisches Journal*, vol. 330 (1915), p. 101]

FORMULA FOR STRESSES IN STRUTS AND TIE-RODS IN MOTION

Consider, for example, a locomotive coupling rod of length l to be subjected to a uniform load of $w_1 = w + \frac{w}{g} a^2 r$ lb. per unit run, where w is the weight of unit length of the rod; then the bending moment due to this load $= \frac{w_1 l^2}{8}$, and the stress due to this bending moment $= \frac{w_1 l^2}{8 Z} = f_m$. The deflection at the center due to this uniform load is

$$\frac{5}{384} \frac{w_1 l^4}{EI} = \delta$$

The stress due to the pressure F acting at a distance δ from the axis $= \frac{F\delta}{Z} = f_n$

The direct stress $= \frac{F}{A} = f$

Total stress $= f + f_m + f_n$

STRESSES IN A COUPLING ROD AS A FUNCTION OF SPEED OF ENGINE AND STEAM PRESSURE

Speed of Engine, Miles per Hour	Steam Pressure, 160 Lb. per Sq. In.	Steam Pressure, 200 Lb. per Sq. In.
	Stress in Rod, Tons per Sq. In.	Stress in Rod, Tons per Sq. In.
10	3.20	3.95
20	3.78	4.60
30	4.70	5.25
40	6.18	6.8
50	7.70	8.7
60	9.82	10.8
70	12.30	13.3
80	15.20	16.4

Treating the rod in this manner, the results given in the accompanying table have been obtained for different speeds of the engine with steam pressures of 160 and 200 lb. per sq. in.

[*Journal, November, 1915, p. 659*]

[Source: *Journal of the Institution of Mechanical Engineers*, October, 1915, London]

FLOW OF VISCOUS FLUIDS THROUGH SMOOTH CIRCULAR PIPES

The form of the final expression for the fall of pressure along a tube of circular cross-section indicates that this fall for all velocities is approximately proportional to the power of the velocity between the 1.65th power and the square.

The difference of pressure $p_0 - p_1$ in dynes per sq. cm. between two sections distant 1 cm. from each other along a pipe of diameter d cm., through which a fluid whose density ρ may be considered constant over the length l and whose kinematical viscosity is ν , is flowing with mean velocity v , cannot be represented by a single power of the velocity but requires for its expression a formula of the type

$$p_0 - p_1 = (l\rho v^2/d)[a + b(\nu/vd)^n]$$

where a , b , and n are constants.

356.

To the extent to which the Principle of Dynamical Similarity is applicable to the flow of fluid in tubes, a , b , and n should be absolute constants applicable to all fluids and all tubes. Stanton and Pannell's results show that over a wide range $a = 0.0018$, $b = 0.153$ and $n = 0.35$.

As the velocity and diameter increase and as the kinematical viscosity decreases, the pressure difference varies more nearly as $l\rho v^2/d$.

The effect of temperature on the pressure difference decreases as the velocity and diameter increase and as the kinematical viscosity decreases.

[*Journal, May, 1915, p. 242*]

[Source: *Proceedings, Royal Society (London)*, Ser. A, vol. 91, no. 623]

PERCOLATION AND UPWARD PRESSURE OF WATER

The following conclusions have been derived from experiments made by the Ohio River Board:

Little or no allowance can safely be made for adhesion of concrete to concrete, or of concrete to rock.

Water pressure is transmitted through concrete, though quite slowly. It is transmitted through joints between concrete and concrete more freely than through solid concrete. Likewise, between concrete and rock.

Water travels in small veins in the joints between concrete and concrete, and between concrete and rock. The amount of space of these small veins, *i. e.*, the area of upward water pressure, varies from nearly 0 in excellent granite foundations to 50 per cent or more in rotten shale.

Only upward pressure of water without free exit is transmitted quickly through washed gravel, and less quickly through gravel aggregate and sand.

If the percolation factor is too small the material under the foundation will blow out and the foundation will fall in. With alluvial soil this blow-out comes with little or no previous warning by boils.

[*Journal, February, 1915, p. 121*]

[Source: *Prof. Memoirs, Corps of Engineers, U. S. A., vol. 7 (1915), no. 31*]

FLOW OF SAND AND WATER THROUGH SPIGOTS

It was found from tests made at the Massachusetts Institute of Technology that the area of a spigot opening can be calculated from the equation

$$a = \frac{fq}{c\sqrt{2gh}}$$

in which a is the area of the spigot opening, f the viscosity of the mixture, q the rate of discharge by volume, c the coefficient of discharge, g acceleration due to gravity, and h the head of water above the spigot.

The term "viscosity" denotes here the ratio of the volume of pure water that will flow through a given orifice under a given head in a given time to the volume of the material under consideration that will flow through the same orifice in the same time under the same conditions.

Further tests have shown that when the amount of sand in the mixture exceeded 30 per cent by weight, the spigot would produce a very thick discharge for a short time, but its continuous operation was not certain, and clogging resulted sooner or later.

[*Journal, March, 1915, p. 188*]

[Source: *Bulletin, Am. Inst. of Mining Engineers, No. 97, January, 1915*]

LAWS OF EFFLUX OF DROPS FROM CAPILLARY ORIFICES

Tests with fifteen tubes of different external and internal diameters (the internal diameters varying from 0.4 to 2.4 mm. and the external diameters from 2.3 to 7 mm.) have led to the following conclusions:

First. The product of the internal diameter d by the interval of time between two drops T , corresponding to the first maximum, is a constant A , or simple multiple of this number. From the frequency zero to that which corresponds to the first maximum the weight of the drops varies nearly in a straight line with the frequency (after the passage of the first maximum the inverse variation becomes more rapid). This straight line as defined above determines, by extrapolation, the weight P_∞ corresponding to frequency 0. This being so,

Second. Quotient of the increase of weight $\delta = P_m - P_\infty$ of the drop from the origin to the first maximum by the internal diameter d is a constant number B or a simple multiple of that number.

Third. A quotient of the weight P_{∞} (at the origin) by the external diameter D is a constant number C . C is, however, different from B , and in addition for tubes for a diameter in excess of 5 mm. it is different from that for tubes with a smaller diameter.

Fourth. From the instant of sudden increase of the weight of the drop, the quotient of this increase of weight by the internal diameter is equal to B or to a simple multiple of B .

[*Journal, July, 1915, p. 407*]

[Source: *Comptes rendus des Séances de l'Académie des Sciences*, vol. 160 (1915), p. 596]

ABSORPTION OF MOISTURE BY COKE KEPT UNDER WATER (WATER CONTENTS IN PER CENT)

No. of Sample	Original Water Content	Moisture absorbed after coke has been kept under water for				
		1 hr.	3 hr.	6 hr.	24 hr.	28 hr.
1	8	18.2	17	17	15.7	14.4
2	8.5	14.5	13.3	13.3	13.3	13.3
3	6.7	11.2	11.2	....	10.1	8.9
4	10.4	12.6	12.6	....	11.5	11.5

[*Journal, September, 1915, p. 559*]

[Source: *Zeit. für Dampfkessel*, vol. 38 (1915), p. 241]

358

CHIMNEYS

The general formula for the draft required to produce a given change in velocity is (with the factor 0.192 for converting pounds per square foot to inches of water):

$$P_v = 0.192 \frac{P}{30} \left(\frac{41.3}{(t_c + 459.6)} \right) \left(\frac{v_2^2 - v_1^2}{2g} \right)$$

or finally

$$P_v = 0.123 \frac{P(v_2^2 - v_1^2)}{30(t_c + 459.6)}$$

The maximum weight of coal (C) to be burned in pounds per square foot of grate surface per hour may be found from the following formula:

$$C = \frac{(\text{h.p.}) \times 33480}{U E G}$$

where (h.p.) is the maximum horsepower to be developed, U is the calorific value of the coal in B.t.u. per lb., E is the efficiency of the combined generator and G is the grate surface in sq. ft.

[*A. L. Menzin. Trans., vol. 37, p. 1065*]

EDDY RINGS IN FIRETUBE BOILERS

Eddy rings are intended for deflecting that part of the gas stream flowing through the fire tubes of a boiler which is nearest to the walls of the tube, and, therefore, coldest, and in this way mixing it with the hotter part of the gas stream, thus securing a fuller exchange of heat between water and gas.

Such rings (Pielock system) have been tested in Germany on three tugboats, and the data are reported in the accompanying table. The rings are withdrawable and may be used also in superheaters and water-feed preheaters. In condensers they can be applied only when the cooling water is pure.

TESTS OF EDDY RINGS ON TUGBOAT BOILERS

	Tug <i>Moritz</i>		Tug <i>Otto</i>		Tug <i>Ernst</i>	
	No rings	Eddy rings	No rings	Eddy rings	No rings	Eddy rings
Duration of test, min.....	108	124	109	140	108	135
Boiler pressure, atmos.....	10	10	10	10	12	12
Cut-off, per cent.....	55	55	65	65	65	65
Speed of engine, r.p.m.....	162	162	156	156	164	164
Coal consumption, total { kg.....	500	500	500	500	500	500
{ lb.....	1102	1102	1102	1102	1102	1102
Coal consumption per hour { kg.....	277	241	275	214	277	222
{ lb.....	609	530	605	470	609	488
Temperature of flue gases { deg. cent.....	312	260	320	255	350	275
{ deg. fahr.....	593.6	500	608	491	662	527
Trailer, in 100 kg.....	10000	10000	9500	11000	12800	13000
Saving in coal, per cent.....	.....	12.9	.....	22.14	.....	20

[*Journal, February, 1915, p. 117*]

[Source: *Schiffbau*, vol. 16 (1914), p. 72]

DATA ON STEAM PIPE COVERINGS

For pipe coverings with white canvas surfaces the total flow of heat in B.t.u. per sq. ft. of pipe surface per hour through a covering = $W_1 = at_0$, where a is taken from the accompanying table and t_0 is the difference in temperature between the pipe surface and the air, in deg. fahr.

The total B.t.u. loss per hour per sq. ft. of outside surface of covering = $W_2 = W_1 r_1 / (r_1 + s)$, where r_1 = outside radius of pipe and s = thickness of covering, both in inches.

The temperature difference between the outer surface of the covering and the air corresponding to the loss W_2 is $T_0 = (328W_2 - 220) / (W_2 + 390)$, and the conductivity for a given value of T_0 is $k = W_1 r_2 (\log_e r_1 - \log_e r_2) / T_0$, where $r_2 = r_1 + s$.

The heat loss through any thickness of any material of which the value of k is known for $t_0 \leq 500$ deg. fahr., is $W_2 = k(t_1 - t_2 - T_0) / [r_2 (\log_e r_2 - \log_e r_1)]$, where t_1 and t_2 are the temperatures respectively of the pipe surface and room.

MECHANICAL ENGINEERING DATA

The value of W_2 for any pipe covering surfaced with white canvas may be determined by solving the equation $t_1 - t_2 = (328 W_2 - 220)/(W_2 + 390)$, in which t_1 is the reading of a thermometer that has been placed just under the canvas.

The heat loss (b) from bare pipe per hour per sq. ft. of surface per degree difference in temperature is as follows:

Temp. difference, deg. fahr.....	50	100	200	300	400	500
Loss, in B.t.u. (b).....	1.95	2.152	2.665	3.260	4.035	5.180

The saving due to the use of a covering = $b - a$, and the efficiency of a covering in per cent = $100 (b - a)/b$.

DATA ON STEAM-PIPE COVERINGS

Name of covering	Thick- ness of single cover- ing, inches	k (for temp. diff. of 300 deg. fahr.)	B.t.u. loss per sq. ft. per deg. temp. diff. per hour for single-thickness covered pipes (= a)					
			Temperature difference (pipe and room), deg. fahr.					
			50	100	200	300	400	500
J-M 85 per cent. Magnesia	1.08	0.551	0.435	0.438	0.446	0.455	0.469	0.488
J-M Indented	1.12	0.686	0.472	0.483	0.309	0.549	0.603	0.666
J-M Vitribestos	0.96	1.087	0.626	0.654	0.715	0.781	0.856	0.967
J-M Eureka	1.04	0.549	0.440	0.451	0.464	0.478	.....	.....
J-M Molded Asbestos	1.25	0.778	0.517	0.522	0.539	0.561	0.596	.....
J-M Wool Felt	1.10	0.521	0.386	0.400	0.421	0.442	.....	.....
Sall-Mo Expanded Asbestos	1.07	0.598	0.409	0.427	0.464	0.503	0.541	0.581
Carey Carocel	0.99	0.540	0.358	0.378	0.421	0.466	0.510	0.562
Carey Serrated	1.00	0.682	0.454	0.468	0.506	0.546	0.587	0.634
Carey Duplex	0.96	0.636	0.423	0.447	0.498	0.548	.....	.....
Carey 85 per cent Magnesia	1.10	0.546	0.413	0.418	0.424	0.436	0.454	0.472
Sall-Mo Wool Felt	1.01	0.510	0.395	0.401	0.433	0.459	.....	.....
Nonpareil High Pressure	1.16	0.543	0.399	0.402	0.412	0.426	0.444	0.465
J-M Asbestos Fire Felt	0.99	1.093	0.694	0.711	0.749	0.795	0.845	0.901
J-M Asbestos Sponge Felted	1.16	0.468	0.336	0.347	0.369	0.391	0.414	0.439
J-M Asbestocel	1.10	0.596	0.418	0.429	0.454	0.493	0.544	0.609
J-M Air Cell	1.00	0.718	0.459	0.475	0.515	0.571	0.643	0.733

[L. B. McMillan. *Trans.*, 1915, vol. 37, p. 921]

CHART FOR DETERMINING MEAN TEMPERATURE DIFFERENCES

It is generally assumed that the transmission of heat by steam, gas or liquid through metal divisions is proportional to the difference in temperature between the substances. But generally the temperature of each of the substances is not the same at all parts of the surface. In the case of feed-water heaters, condensers, etc., the temperature of the steam may be taken as constant, but the temperature of the water decreases or increases as the case may be in its passage over the surface. For purposes of computation it is therefore necessary to determine a mean temperature difference value. Probably the most reliable formula for the purpose is that of Grashof:

MECHANICAL ENGINEERING DATA

Mean temperature difference = $D = (T_2 - T_1) / \log_e[(T_3 - T_1)/(T_3 - T_2)]$
 where $T_1(T_2)$ = lowest (highest) temperature of the fluid, and T_3 = temperature of the gas. The result will not be changed if any constant be deducted from all of the T 's in the equation. The accompanying chart is based on this formula and furnishes a rapid means of determining mean temperature differences.

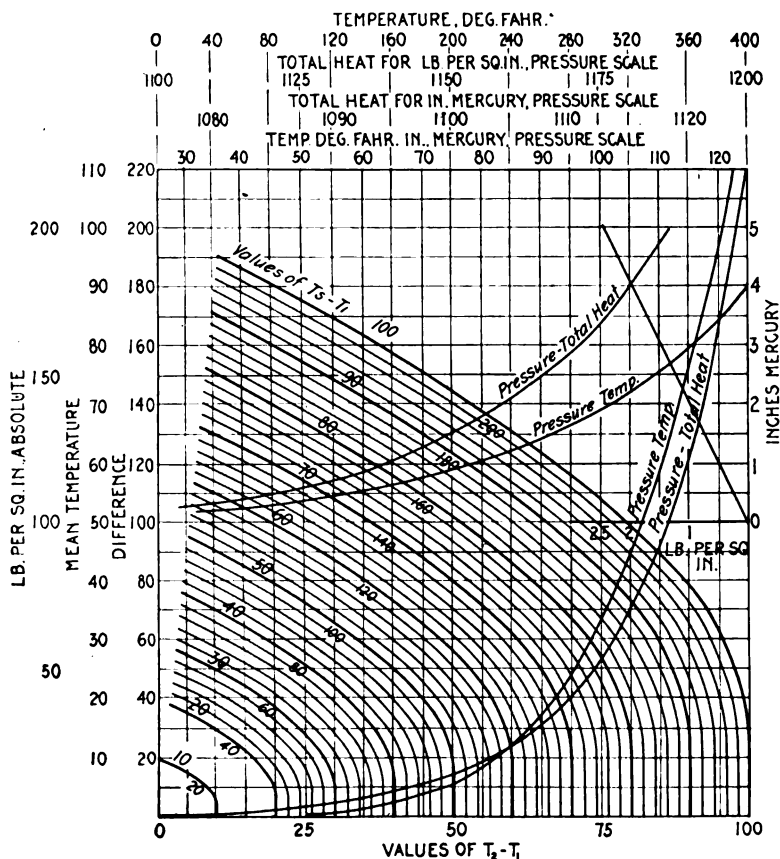


FIG. 2 CHART FOR DETERMINING MEAN TEMPERATURE DIFFERENCES

For example, with $T_1 = 60$ deg. fahr., $T_2 = 100$ deg., and $T_3 = 110$ deg., $T_2 - T_1 = 40$ and $T_3 - T_1 = 50$; the ordinate at 40 on the base scale intersects the $T_3 - T_1$ curve, giving $D = 25$ deg. To increase the range two scales are given; for temperatures between 200 and 1000 deg., use the 100-scale. Five other curves showing pressure-heat-temperature relations of steam are also given on the chart for convenient reference.

[C. F. Braun. Trans., 1915, vol. 37, p. 220]

HIGHER STEAM PRESSURES FOR ENGINES AND TURBINES

The following tables give the theoretical percentages of gain for certain comparisons which have been selected on account of their relation to conditions prevailing in present-day practice. These tables show that, even in the case of high vacuum in the condenser, the gains, while not overwhelmingly large, deserve careful attention; and that in the case of atmospheric exhaust these gains are so large as to justify fully an endeavor to realize high steam pressure in practice.

RELATIVE GAIN IN THERMAL EFFICIENCY DUE TO INCREASING STEAM PRESSURE TO 600 LB. PER SQ. IN. ABS.

FINAL CONDITION OF STEAM	29 IN. VACUUM		ATMOSPHERIC EXHAUST	
	Constant Temperature, 600 Deg. Fahr.	Constant Superheat, 100 Deg.	Constant Temperature, 600 Deg. Fahr.	Constant Superheat, 100 Deg.
As against 100 lb. initial pressure.....	25 per cent	30 per cent	52 per cent	85 per cent
As against 200 lb. initial pressure.....	13 per cent	15½ per cent	32 per cent	37½ per cent

RELATIVE GAIN IN THERMAL EFFICIENCY DUE TO INCREASING STEAM PRESSURE TO 1574 LB. PER SQ. IN. ABS.

Final Condition of Steam	29 In. Vacuum	Atmospheric Exhaust
As against 100 lb. initial pressure, 100 deg. fahr. superheat...	41½ per cent	187 per cent
As against 200 lb. initial pressure, 218 deg. fahr. superheat...	22½ per cent	105 per cent

[R. Cramer. *Trans.*, 1915, vol. 37, p. 597]

COMPARATIVE DATA SHOWING THE VARIATION IN THE NUMBER OF BOILER ACCIDENTS IN THE LAST 18 YEARS

CAUSES	Explosions to each 10,000 boilers in the period:		Accidents to each 10,000 boilers in the period:	
	1885-9	1909-13	1885-9	1909-13
Defects in material and workmanship.....	0.352	0.120	4.48	1.78
Defects in piping connections and auxiliary apparatus.....	0.246	0.069	2.04	1.84
Defective attendance.....	0.815	0.225	5.83	6.82
Defective operation.....	0.351	0.135	5.26	3.90

[*Journal*, October, 1915, p. 609]

[Source: *Zeit. d. Ver. deutsch. Ing.*, vol. 59 (1915), p. 681]

STANDARDS RELATING TO CAPACITY, EFFICIENCY AND ECONOMY
OF POWER PLANT APPARATUS

[From Report of Power Test Committee. Trans., vol. 37 (1915), p. 1295]

DEFINITION OF UNITS

One British thermal unit (B.t.u.), or heat unit as herein used = $1/180$ of the heat required to raise 1 lb. of water from 32 deg. to 212 deg. fahr.

One unit of evaporation (U. E.) = heat required to evaporate 1 lb. of water at 212 deg. into steam at the same temperature = 970.4 British thermal units.

Mechanical equivalent of heat: 1 B.t.u. = 777.54 ft.-lb., or 1 ft.-lb. = 0.0012861 B.t.u.¹

One pound (of force) = the force exerted by gravity on 1 lb. of matter where the acceleration due to gravity is 32.1740 ft. per second per second; that is, (very nearly) the force of gravity on 1 lb. of matter at latitude 45 deg. at the sea level.

One horsepower = 33,000 ft.-lb. per min. = 550 ft.-lb. per sec.
= 1,980,000 ft.-lb. per hour.
= 2,546.5 B.t.u. per hour = 42.44 B.t.u. per min.
= 745.7 watts = 0.7457 kilowatt.

One kilowatt = 1000 watts = 1.3410 h.p. = 3,415 B.t.u. per hour
= 737.56 ft.-lb. per sec.

One kilowatt-hour = 1.3410 h.p.hr. = 2,655,200 ft.-lb.

One atmosphere = 760 mm. or 29.921 in. of mercury at 32 deg. fahr.
= 29.951 in. of mercury at 62 deg. fahr.
= 14.6963 lb. per sq. in.

Absolute temperature (deg. fahr.) = temperature by thermometer plus 460 deg.

¹ Based on the following accepted values:

1 mean calorie = 4.1834×107 dyne-centimeters (Marks & Davis)

1 dyne = $\frac{1 \text{ gram}}{980.665}$ (International Standard). 1 cm. = $\frac{0.3937}{12}$ ft.

1 B.t.u. = 1.8 lb.-deg. cent. 1 gram = 0.002204622 lb.

1 watt = 10.7 dyne-centimeters per sec. = 0.73756046 ft.-lb. per sec.

1 h.p. = 550 ft.-lb. per sec. = $\frac{550}{0.73756046}$ = 745.702 watts

STANDARD UNITS OF CAPACITY

<i>a</i> Boilers*.....	{	One pound of water evaporated into dry steam from and at 212 deg. per hour
<i>b</i> Reciprocating Steam Engines.....		One indicated horsepower developed in the main cylinders One brake horsepower delivered by the main shaft
<i>c</i> Steam Turbines.....	{	One brake horsepower delivered by the main shaft
<i>d</i> Turbo-generators (including engine-driven generators).....	{	One kilowatt delivered at the generator terminals,† not including kilowatts used by exciter‡

<i>e</i> Pumping Machinery.....	One gallon of water discharged to the force main in 24 hr. One gallon of water discharged per min. § One water horsepower delivered to the force main, based on the total head including suction
<i>f</i> Compressors, Blowers, and Fans.....	One cu. ft. of air at 62 deg. and 30 in. ¶ One air horsepower
<i>g</i> Locomotives.....	One indicated horsepower developed in the main cylinders One dynamometer horsepower delivered to the draw-bar
<i>h</i> Gas Producers.....	One pound of dry fuel of given quality consumed per hour One cu. ft. per hour of dry gas having a stated quality at 60 deg. and 30 in.
<i>i</i> Gas and Oil Engines.....	One brake horsepower delivered by the main shaft One indicated horsepower developed in the engine cylinder
<i>j</i> Waterwheels.....	One brake horsepower delivered by the main shaft One kilowatt delivered at the generator terminals, † not including kilowatts used by exciter ‡

* A subsidiary unit which may be used for stationary boilers is a "Boiler Horsepower," or 34½ lb. of water evaporated from and at 212 deg. per hour, *i. e.*, from water at 212 deg. into steam at the same temperature. The unit called "Myriawatt" has been suggested by some engineers as a unit of boiler capacity. It is 2 per cent greater than the "boiler horsepower" and is equivalent to 34,150 heat units per hour, the "boiler horsepower" being 33,479 heat units per hour.

† If switchboard instruments are used for the electrical measurements, correction should be made for the drop in voltage between generator and switchboard, unless the drop is so small as to be negligible.

‡ If the exciter current is taken from an outside source the kw. thus supplied including field rheostat losses are to be deducted from the total output. Likewise the kw. used by separately driven ventilating fan.

§ This unit applies to small pumps and some classes of large sized pumps.

¶ 30 in. mercury barometer refers in round numbers to a standard atmosphere at 62 deg. In exact figures the standard atmosphere is 29.951 in. of mercury at 62 deg.

STANDARDS OF EFFICIENCY AND ECONOMY

<i>a</i> Boilers.....	Relation between B.t.u. absorbed by boiler per lb. of dry coal and calorific value of 1 lb. dry coal. (Efficiency of boiler furnace and grate.) Relation between B.t.u. absorbed by boiler, per lb. of combustible burned and calorific value of 1 lb. combustible. (Efficiency based on combustible.)
-----------------------	---

NOTE:—The term "steam" in this table means dry steam, either saturated or superheated as the case may be. If it contains moisture, the moisture is to be deducted. If superheated, no correction is to be made.

<i>b</i> Reciprocating Steam Engines.....	{	(1) B.t.u. per i.h.p-hr. (2) B.t.u. per brake h.p-hr. (3) Ft-lb. of net work per B.t.u. (4) Thermal efficiency referred to i.h.p. (5) Thermal efficiency referred to br. h.p. (6) Rankine cycle ratio referred to i.h.p. (7) Rankine cycle ratio referred to br. h.p. (8) Lb. of steam per i.h.p-hr. (9) Lb. of steam per br. h.p-hr.
<i>c</i> Steam Turbines.....	{	(1) B.t.u. per br. h.p-hr. (2) Ft-lb. of net work per B.t.u. (3) Thermal efficiency. (4) Rankine cycle ratio. (5) Lb. of steam per br. h.p-hr.
<i>d</i> Turbo-generators (in- cluding engine-driven generators).....	{	(1) B.t.u. per kw-hr. (2) Ft-lb. of net work per B.t.u. (3) Thermal efficiency. (4) Rankine cycle ratio. (5) Lb. of steam per kw-hr.
<i>e</i> Pumping Engines.....	{	(1) Ft-lb. of work per million B.t.u. (2) Ft-lb. of net work per B.t.u.
<i>f</i> Compressors, Blowers, and Fans.....	{	(1) B.t.u. per net air h.p-hr. (2) Ft-lb. of net work per B.t.u. (3) Lb. of steam per net air h.p-hr. (4) Lb. of steam per 1000 cu. ft. of free air com- pressed to 100 lb. gage pressure reduced to atmospheric temperature.

g Complete Steam Power Plants:

Plants in General.....	{	(1) Lb. of coal as fired per i.h.p-hr. (2) Lb. of steam per i.h.p-hr. (3) Heat units in fuel consumed per i.h.p-hr.
Electric Plants.....	{	(1) Lb. of coal as fired per kw-hr. (2) Lb. of steam per kw-hr. (3) Heat units in fuel consumed per kw-hr.
Pumping Plants.....	{	(1) Ft-lb. of work per million B.t.u. (2) Lb. of coal as fired per water h.p-hr.
Air Machinery Plants.....	{	(1) Lb. of coal as fired per air h.p-hr. (2) Lb. of steam per air h.p-hr.

NOTE:—The i. h. p. and brake h. p. in this table refer to that of the main engine, turbine, or waterwheel, and the kw. to the power measured at the generator terminals, not including exciter output.

<i>h</i> Locomotives.....	{	(1) Lb. of coal as fired per i.h.p-hr. (2) Lb. of coal as fired per dyn. h.p-hr. (3) Lb. of steam per i.h.p-hr. (4) Lb. of steam per dyn. h.p-hr. (5) Lb. of coal as fired per ton-mile.
<i>i</i> Gas Producers.....	{	Relation between B.t.u. of the gas output per lb. of dry fuel and calorific value of 1 lb. of dry fuel.
<i>j</i> Gas and Oil Engines..	{	(1) B.t.u. per i.h.p-hr. (2) B.t.u. per br. h.p-hr. (3) Ft-lb. of net work per B.t.u. (4) Thermal efficiency referred to i.h.p. (5) Thermal efficiency referred to br. h.p. (6) Lb. of oil per i.h.p-hr. (7) Lb. of oil per br. h.p-hr. (8) Cu. ft. of dry gas at 60 deg. and 30 in. per i.h.p-hr. (9) Cu. ft. of dry gas at 60 deg. and 30 in. per br. h.p-hr.
<i>k</i> Waterwheels.....	{	(1) Relation between brake h.p. and potential h.p. of total water used. (2) Relation between kw-hr. delivered and potential kw-hr.

The English Standards used in the preceding tables may be converted into metric units (and *vice versa*) by the use of the following factors:

Factors for Converting English Units to Metric Units.

One inch	= 2.54	centimeters
One foot	= 0.3048	meter
One sq. in.	= 6.4516	sq. cm.
One cu. ft.	= 0.028317	cubic meter
One U. S. gallon	= 3.7854	liters
One pound	= 0.453592	kilogram
One lb. per sq. in.	= 0.070307	kg. per sq. cm.
One foot-pound	= 0.13826	meter-kilogram
One horsepower	= 1.0139	cheval-vapeur
One B.t.u.	= 0.252	kilogram-calorie
One deg. fahr.	= 0.55556	deg. centigrade

Factors for Converting Metric Units to English Units.

One centimeter	= 0.3937	inch
One meter	= 3.28083	feet
One sq. cm.	= 0.155	sq. in.
One cubic meter	= 35.3145	cu. ft.
One liter	= 0.26417	U. S. gallon
One kilogram	= 2.20462	pounds
One kg. per sq. cm.	= 14.223	lb. per sq. in.
One meter-kilogram	= 7.233	foot-pounds
One cheval-vapeur	= 0.98629	horsepower
One kilogram-calorie	= 3.9683	B.t.u.
One deg. centigrade	= 1.8	deg. fahr.

The "calorific value" of fuel is the number of heat units developed in completely burning one pound of the fuel, including the heat contained in any water vapor formed through burning the hydrogen component. This is the higher heat value and not the so-called net or available heat value, in obtaining which the latent heat in the vapor thus formed is deducted.

QUALITY OF STEAM AND LOAD ON THE BOILER IN THE CASE OF
A CORNISH BOILER

Tests made by the Bavarian (Germany) Association for boiler inspection have shown that in the case of Cornish as well as in that of water-tube boilers the moisture in the steam decreases with the increase of load, but the water-tube boiler produces steam of greater moisture than the Cornish boiler.

[*Journal, March, 1915, p. 185*]

[Source: *Zeit. d. Bayerischen Revisions-Vereins*, vol. 18 (1915), p. 203]

367

STRESSES IN SAFETY-VALVE SPRINGS

The maximum fiber stress in the spring occurs at the middle of the inside edge of section of the spring coil and is made up of the four component stresses due to torsion, direct shear, bending and direct compression. The effect of the last two is sufficiently slight to be neglected. The first two produce a maximum shearing fiber stress, which is calculated for a valve lift of 0.100 in. by the following formula:

$$S = \frac{9Q \cos \theta R}{2bh^2} + \frac{Q \cos \theta}{A}$$

where Q = load on spring in pounds; R = the mean radius of the coil measured from the axis of the spring to the center of gravity of section in inches; θ = the angle of inclination of coil to a plane perpendicular to the axis of the coil. The shearing modulus of the spring material is calculated for a valve lift of 0.100 in. by the following formula:

$$d = \frac{Q \cos^2 \theta R^2 L}{CJG} + \frac{Q \cos^2 \theta L}{AG}$$

in which d = axial deflection per coil in inches

Q = load on spring in pounds

R = mean radius of coil in inches (by measurement)

p = pitch of coils in inches

$L = (p - d)^2 + (2\pi R)^2$ = length of one free coil in inches actively opposing the compression of the spring

$\cos \theta = 2\pi R/L$

C = St. Venant's constant for the resistance to torsion of bars of nearly square section

h = altitude of trapezoidal section in inches

B = larger base in inches

b = smaller base in inches

$A = \frac{1}{2}h(B + b)$ = area of section in square inches

$J = \frac{h}{48} (B^3 + B^2b + Bb^2 + b^3) + \frac{h^3}{36} \left(\frac{B^2 + 4Bb + b^2}{B + b} \right)$

= polar moment of inertia of trapezoidal section in inches

G = shearing modulus of elasticity in pounds per square inch.

[*Journal*, October, 1915, p. 611]

[Source: *Journal*, American Society of Naval Engineers, August, 1915]

COOLING TOWERS

368

With other conditions remaining the same, the temperature ratio of "air out" to "water in" represents the real efficiency of a cooling tower. In a well-designed cooling tower the humidity of the air leaving the tower is always 100 per cent.

The following data were obtained in tests on cooling towers made by the Wheeler Condenser & Engineering Company, of Carteret, N. J.:

TESTS ON A FORCED-DRAFT COOLING TOWER
(Averages of Three-Hour Readings)

Gal. per min.	Water			Air				
	Temperature, deg. Fahr.		B.t.u. per min.	Temperature, deg. Fahr.		Humidity, per cent		Quantity measured by ane- mometer, cu. ft. per min.
	In	Out		In	Out	In	Out	
651	105	84.7	110,000	71	90	40	100	53,900
638	107.8	87.5	108,000	72	93	60	100	50,100
638	112	88.5	124,500	64	96	60	100	51,400
643	108.5	87	115,000	69	92	48	100	52,200
640	109.9	90.5	103,400	83	95	48	100	50,600
632 ¹	116	98	94,800	43	101	75	100	23,500
630 ¹	135	115.8	102,000	60	118	73	100	15,575

¹ Natural draft, fan not running.

[*Journal*, January, 1915, p. 59]

[Source: *Journal*, Ohio Society of Mechanical, Electrical and Steam Engineers, November, 1914]

TEMPERATURES OF COMBUSTION AND EXPLOSION OF GASES

$$T = \frac{WE}{\text{cbm.CO}_2(0.4886 + 0.00024t) + \text{cbm.H}_2\text{O}(0.4692 + 0.00015t)} + \frac{WE}{\text{cbm.N}(0.308 + 0.00007t)}$$

In the accompanying table the volumes of the explosive mixtures are given before and after combustion, and from this are computed the gage pressures available during explosion.

	Initial Volume	Final Volume	Initial Volume	Final Volume	INITIAL TEMPERATURES				PRESSURES	
					at constant specific heat		with vary- (up- wards) specific heat			
	with oxygen Cbm.	with oxygen Cbm.	with theoretical amount of air Cbm.	with theoretical amount of air Cbm.	with oxygen deg. cent.	with theoretical amount of air deg. cent.	with oxygen deg. cent.	with theoretical amount of air deg. cent.	with oxygen Atmospheres	with theoretical amount of air Atmospheres
Hydrogen	3.00	22.93	6.771	42.01	6781	2756	2851	1711	7.63	6.205
Carbon Monoxide	3.00	21.775	6.771	43.361	7067	3042	2694	1775	7.26	6.53
Methane	3.00	34.15	10.542	71.78	7160	2440	2829	1583	11.38	6.86
Acetylene	7.00	85.49	25.855	203.06	3610	1953	12.21	7.85
Ethylene	4.00	51.34	15.313	114.093	8620	2750	3226	1758	12.84	7.45
Benzol	17.00	231.65	73.565	544.47	2790	3234	1717	13.63	7.40
Gasoline	12.00	183.90	53.481	400.78	3068	1661	15.33	7.50
Alcohol	4.00	55.06	15.313	110.063	2728	1566	13.77	7.19
Illuminating Gas.	2.135	22.95	6.435	45.51	7500	2530	3126	1747	10.75	7.07

[Source: *Oel- und Gasmachine*, vol. 15 (1915), p. 25]

COMBUSTION OF BENZOL IN INTERNAL-COMBUSTION ENGINES

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	10 Kg. Load		10 Kg. Load, Defective Ignition	8 Kg. Load		4 Kg. Load
CO ₂	12.5	8.9	6.27	12.0	8.8	8.7
CnHm.....	.....	.....	1.56	.....	.....	0.3
O ₂	1.0	4.1	2.40	1.2	1.2	1.0
CO.....	4.0	6.0	10.25	7.1	10.6	11.1
H ₂	1.2	2.4	2.40	2.3	4.18	5.0
CH ₄	0.2	0.24	0.5	0.25	0.43	1.4
N ₂	81.1	78.36	76.62	77.15	74.79	72.5

[*Journal, January, 1915, p. 47*][Source: *Journal für Gasbeleuchtung*, vol. 57 (1915), pp. 893 and 907]

PROPORTIONS OF HOT BULBS FOR OIL ENGINES

In the case of a relatively thin internally heated tube whose inner radius is r and length is l , both in inches, and in which all the heat is conducted away at one end, it will be found that the total temperature drop over the full length is equal to

$$\theta = \theta_1 - \theta_0 = \frac{1}{2} \frac{H l^2}{k s}$$

The temperature drop over a tube is dependent only upon the length of the tube, and for a unit length the drop is twice that for a disk of unit radius.

If it be assumed that the temperature of the exhausted gases is approximately equal to that of the cap, fairly reliable values for the uniformly distributed heat-input factor H may be taken as follows:

For 2-stroke-cycle engines

$$H = \frac{t_h}{8} \sqrt{\frac{N}{100}}$$

and for 4-stroke-cycle engines

$$H = \frac{t_h}{11} \sqrt{\frac{N}{200}}$$

where N = engine speed in r.p.m.

t_h = effective temperature head in deg. Fahr. as measured by the average temperature maintained during expansion with respect to the heat-absorbing jacket wall

H = B.t.u. per sq. in. of cap surface per hr.

These formulae hold good only for relatively hot caps.

The cap temperature for a two-stroke-cycle engine is found to be

$$t_c = \frac{\left(t_a \sqrt{\frac{N}{100}} - 8 h \right) \frac{l_c^2}{24 k s} + \theta_0}{1 + \sqrt{\frac{N}{100}} \cdot \frac{l_c^2}{24 k s}}$$

where

- θ_1 = temperature of disk at center, deg. fahr.
- θ_0 = temperature of disk, at edge, deg. fahr.
- $\theta = \theta_1 - \theta_0$ = temperature drop from center to edge of disk
- r = radius of disk in.
- s = uniform thickness of disk, in.
- H = uniformly distributed gross heat-input in B.t.u. per hr. per sq. in. of area
- k = specific thermal conductivity in B.t.u. per hr. per sq. in. of section at 1 deg. fahr. head
= about 3.82 for cast iron.

[L. Illmer. *Trans.*, vol. 37, p. 845]

CHARACTERISTIC CURVES OF CENTRIFUGAL PUMPS

Diagram, Fig. 3, contains three series of curves. The set showing the relation between head in feet and capacity in gallons per minute, with speed remaining constant, shows how the head decreases with increase in capacity except for very small discharges.

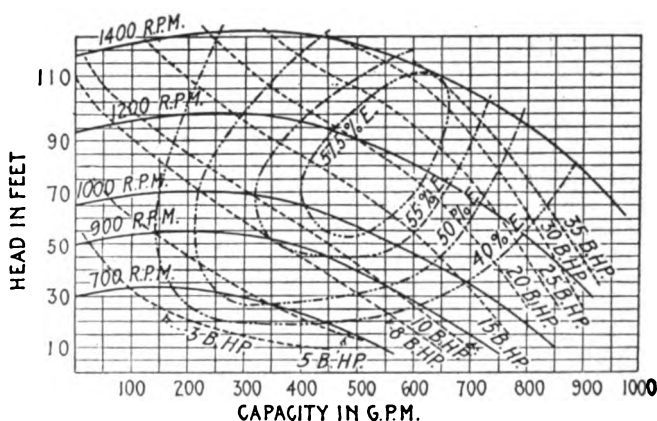


FIG. 3 CHARACTERISTIC CURVES OF CENTRIFUGAL PUMPS

The efficiency curves are similar to an ellipse, the major and minor axes of each curve intersecting in a common point of origin which is also the point of maximum efficiency. The fact that these iso-efficiency curves are concentric is important, as when an efficiency is required for which no curves have been drawn, a new curve may be sketched in with reasonable accuracy.

[*Journal*, January, 1916, p. 59]

[Source: *Journal*, Western Society of Engineers, October, 1914]

DISK FRICTION IN TURBINE PUMPS

The loss due to friction on both faces of a disk, without considering axial thickness and without taking into account the axial extension of the disk, may be expressed by the equation

$$\text{h.p.}f^1 = \frac{4 \pi^{n+2} f}{550.30^{n+1} \cdot 2^{n+3}} N^{n+1} \frac{D_2^{n+3}}{n+3^n} \quad [1]$$

where

$\text{h.p.}f^1$ = horsepower.

f = coefficient of friction, see Fig. 4, a , b and c .

n = exponent of friction, see Fig. 4, a , b and c .

N = r.p.m. of disk.

D_2 = largest diameter of disk.

In order to find the total loss due to friction of both the circumferential and lateral faces of a disk, the value of $\text{h.p.}f^1$ obtained for the latter (equation [1]) should be multiplied by

$$1 + \frac{b}{D_2} (n + 3) \quad [2]$$

where b is the total axial thickness of the disk, expressed in the same measure as D_2 .

If the rotary speed of the waste-water N_T is different under two sides of the same impeller, an axial thrust results. The final equation for the differential axial force is

$$P_a = \frac{N_T^2 - N_{T1}^2}{1000} [2.08 (D_2^3 - D_1^3) D_2^3 - (D_2^4 - D_1^4)] \quad [3]$$

where

N_T and N_{T1} = r.p.m. of waste-water bodies on two sides of impeller.

D_2 = outer diameter of impeller in ft.

D_1 = diameter of clearance of slip-rings in ft.

P_a = axial thrust resulting from difference between N_T and N_{T1} , in lb.

P_a depends on the fourth power of the diameter. No appreciable inaccuracy is caused by disregarding the central part of the impeller.

[*F zur Nedden. Trans., vol. 37, p. 83*]

HYGROSCOPIC PROPERTIES OF CALCIUM CHLORIDE SOLUTIONS AT DIFFERENT TEMPERATURES

A 30 per cent solution neither loses nor gains water at 60 deg. fahr. At 30 deg. fahr. 20 per cent brine gives off water fairly rapidly, and 25 per cent brine neither gains nor loses weight, while 30 per cent brine absorbs moisture from the air rapidly. At 16 deg. fahr. 20 per cent brine slowly absorbs, 25 per cent absorbs rapidly, and 30 per cent takes in moisture with great avidity.

[*Journal, January, 1915, p. 52*]

[Source: *Proceedings, Cold Storage and Ice Association (London), 1913-1914*]

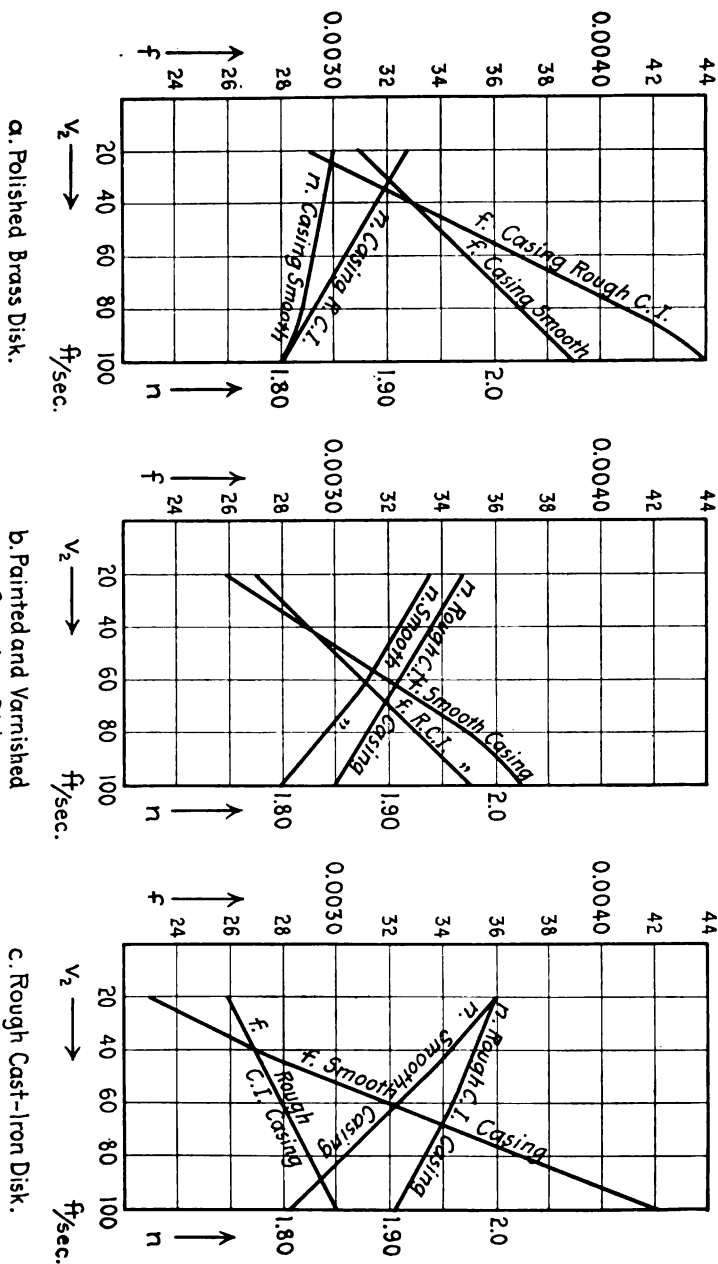


FIG. 4 DIAGRAMS OF DISK FRICTION ON POLISHED, PAINTED AND ROUGH SURFACES

SPECIFIC HEAT AND HEAT OF FUSION OF ICE

An investigation by the Bureau of Standards at Washington, D. C., has indicated that the curves of specific heat of ice are asymptotic to a straight line, the departure from which is apparent at temperatures varying from -8 to -2 deg. for various samples.

It has been found that at a given temperature, θ , between -40 and -2 deg. for the purest ice experimented on, the specific heat, in 20-deg. calories per gram per degree, is represented within the limits of experimental accuracy by the equation

$$S = 0.5057 + 0.001863 \theta$$

and that from -2 to -0.05 deg. the specific heat for pure ice does not depart from the value given by the above equation by more than $0.004/\theta^2$. The specific heat of impure ice at a temperature θ above -40 deg. is greater than that of pure ice by lL/θ^2 , where L is the heat of fusion and l the initial freezing point.

The value found for the heat of fusion of ice is 79.76 20-deg. calories per gram, which is within $1/4000$ of the value previously determined at the Bureau by a different method, employing a stirred-water calorimeter.

[*Journal, May, 1915, p. 294*]

[Source: *Journal of the American Society of Refrigerating Engineers, March, 1915*]

374

AIR CARRIERS

Formula for the quantity of air used in tubes working intermittently:

$$Q = \frac{V}{13.08} \frac{p' - p''}{14.7}$$

where Q = pounds of air; V = container volume, cu. ft.; 13.08 = cu. ft. of air in 1 lb. at 60 deg. fahr.; and $p' - p''$ = drop in the container pressure in lb. per sq. in., the temperature of the container being assumed to be constant during the time of the test.

When working "vacuum" with the same vacuum in the container, the same amount of air, 7 lb., is used no matter what the throttling may be.

Tests at Hull made in 1911 have shown that increased speed with high vacuum was obtained without any increase in air consumption (but with an increase in energy consumption, however, because the air is taken to a higher vacuum).

In house tube work it would be necessary to allow a consumption of air of from 1.25 to 2 times the volume of the tube. If the speed is high, the consumption will rise to 2 or 2.5 times the volume of the tube.

As to leakages, leakage from the container, pipe-work and cocks amounted at Brighton to about 68 lb. of air per day. The leakage at Hull on a vacuum container caused a rise of 2 lb. in $3\frac{1}{2}$ min., equivalent to about 0.2 lb. per min. extra work.

For tube leakage in London, the following amounts (including leakage from D-boxes, double slide switches and fittings) were found for individual tubes: 0.22, 0.30, 0.47, 0.37, 0.60, 5.4 lb. of air per min. The total leakage for nine tubes working on pressures was 4.7 lb., and for 20 tubes working on vacuum 3.5 lb.

[*Journal, July, 1915, p. 418*]

[Source: Paper No. 55, Inst. P. O. Elec. Engrs., London]

DETERMINATION OF DIMENSIONS OF PIPES IN VENTILATING AND HEATING INSTALLATIONS

H = Total pressure in kg. per sq. m.

R = Frictional resistance per meter of piping in kg. per sq. m.

Z = Fall of pressure due to single resistances in kg. per sq. m.

L = Volume of air in cu. m. per sec.

f = Cross-section of the passage in sq. m.

l = Length of passage in meters.

v = Velocity of air in meters per sec.

d = Diameter of passage in millimeters.

g = Acceleration due to gravity in m. per sec. per sec.

γ = Specific weight of air in kg. per cu. m.

a = A constant.

ξ = Resistance coefficient.

375

In the equation

$$H \geq \sum_1^n (lR + Z) \dots \dots \dots [1]$$

all frictional resistance of the air may be expressed by a potential function having the following form:

$$R = \frac{av^n}{d^m} \dots \dots \dots [2]$$

The single resistances are taken care of by the following equation:

$$Z = \xi \frac{v^2}{2g} \cdot \gamma \dots \dots \dots [3]$$

In connection with these three equations, the following is added:

$$L = fv \dots \dots \dots [4]$$

[*Journal, September, 1915, p. 558*]

[Source: *Gesundheits-Ingenieur*, vol. 38 (1915), p. 325]

MECHANICAL ENGINEERING DATA

CHILLED-IRON CRANE WHEELS

SAFE STRENGTH OF CRANE-WHEEL FLANGES AT A FACTOR OF SAFETY OF FIVE

Diameter, Inches	Flange, Inches	Throat, Inches	Rail, Lb.	Strength, Lb.
12	1	1 1/4	40	3,000
	1 1/4	1 1/2	50	5,000
	1 1/2	2	60	8,000
20	1	1 1/4	50	8,000
	1 1/4	1 1/2	60	11,000
	1 1/2	2	80	15,000
24	1 1/4	2 1/4	60	12,000
	1 1/2	2 1/2	80	18,000
	1 3/4	2 3/4	100	25,000
30	1 1/4	1 3/4	60	16,000
	1 1/2	2	80	22,000
	1 3/4	2 1/2	100	32,000
36	2	3	100	47,000
	2 1/4	3 1/2	150	69,000
	1 1/4	1 3/4	60	20,000
36	1 1/4	2	80	26,000
	1 3/4	2 1/2	100	38,000
	2	3	100	56,000
	2 1/4	3 1/2	150	86,000

CONTACT AREAS AND PRESSURES

Load in Lb.	33-In. Chilled Wheel		44-In. Steel Driver	
	Contact Area, Sq. In.	Pressure, Lb. per Sq. In.	Contact Area, Sq. In.	Pressure, Lb. per Sq. In.
5,000	0.07	71,500	0.07	71,500
10,000	0.12	83,300	0.15	66,700
15,000	0.16	93,750	0.19	79,000
20,000	0.22	90,900	0.25	80,000
25,000	0.27	92,600	0.30	83,300
30,000	0.35	85,750	0.36	83,300
40,000	0.40	100,000	0.47	85,000
50,000	0.44	113,600	0.50	100,000
60,000	0.57	105,000	0.68	88,300

[Journal, March, 1915, p. 147]

CONVEYOR-BELT CALCULATING CHART

Chart for quickly determining the correct number of plies of conveyor belts operating under specific conditions, namely, maximum load and maximum tension in the belt.

The chart represents graphically the formula

$$p = kgW(L + 10H)$$

where p = the correct number of plies; k = constant, depending on the type of

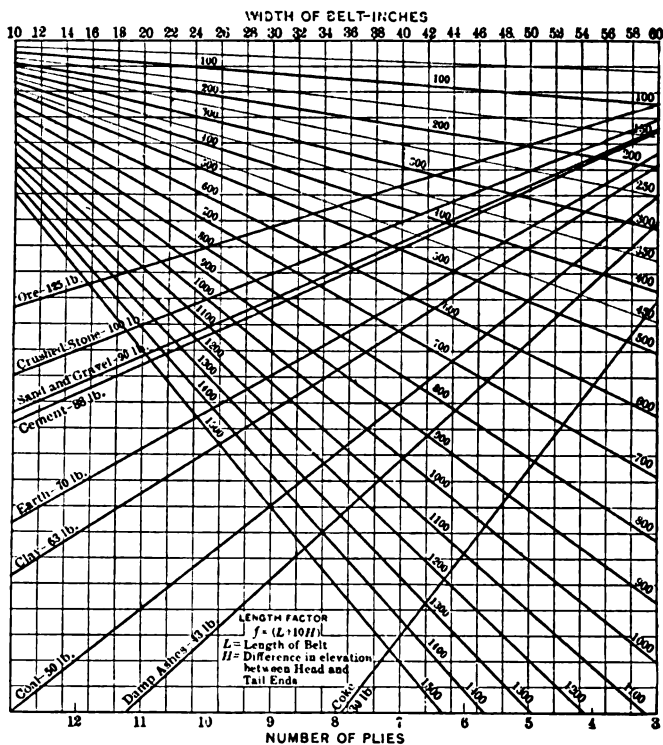


FIG. 5 CONVEYOR-BELT CALCULATING CHART

drive; g = the weight in pounds per cu. ft. of material handled; W = width of the belt in inches; L = length of the belt in feet, approximately twice the center distance; H = the difference in elevation between the head and tail pulleys, in feet.

For a simple drive, with a bare pulley, $k = 1/250,000$; for a simple drive, with a rubber-lagged pulley, $k = 1/300,000$; for a tandem drive with bare pulleys, $k = 1/375,000$ and for a tandem drive with rubber-lagged pulleys, $k = 1/455,000$.

The chart is drawn for a simple drive with a bare pulley and, therefore, the number of plies obtained from the chart should be multiplied by the factor 0.83 or 5/6 for simple lagged drive, a factor of 0.67 or 2/3 for tandem bare, and a factor of 0.55 or 11/20 for tandem lagged drive.

For example, to find the correct number of plies for a conveyor belt 36 in. wide and 300 ft. long, with 20 ft. difference in elevation, handling sand and gravel, follow the 500 length line; then follow to the right until the "sand and gravel line" is intersected; then down to the ply scale where the number of plies will be found to be 7.

[*Journal*, October, 1915, p. 610]

[Source: *Bulletin*, Am. Inst. Mining Engineers, September, 1915]

SUMMARY OF INVESTIGATION OF THE BREAKING STRENGTH OF BROWN & SHARPE 14½-DEG. INVOLUTE, AND FELLOWS 20-DEG. INVOLUTE, STUB-TOOTH, CAST-IRON, CUT GEARS

SYMBOLS, BOTH SYSTEMS

W = safe equivalent load at pitch line, pounds
 s = modulus of rupture = 36,000 lb. per sq. in. for cast iron
 p = circular pitch, inches = pitch arc
 f = width of face of gear, inches
 n = number of teeth in gear
 k = factor of safety

Suggested values: $k = 4$, for steady load, no reversal of stress
 $k = 6$, suddenly applied load, no reversal of stress
 $k = 8$, suddenly applied load, with reversal of stress
 v = velocity coefficient. See table
 a = arc of action coefficient. See table

FORMULAE

Brown & Sharpe 14½-deg. involute:

$$W = \frac{s p f}{k} \left(0.154 - \frac{1.26}{n} \right) v a$$

Fellows 20-deg. involute, stub tooth:

$$W = \frac{s p f}{k} \left(0.278 - \frac{2.69}{n} \right) v a$$

Neither formula holds for values of n less than 12.

VALUES OF (v)				VALUES OF (a)	
Pitch velocity, ft. per min.	v		Pitch velocity, ft. per min.	v	
	Brown & Sharpe 14½-deg. involute	Fellows 20-deg. involute stub tooth		Brown & Sharpe 14-deg. involute	Fellows 20-deg. involute stub tooth
0000	1.000	1.000	1100	0.470	0.540
100	0.795	0.925	1200	0.455	0.525
200	0.750	0.875	1300	0.445	0.515
300	0.730	0.855	1400	0.435	0.505
400	0.715	0.835	1500	0.430	0.495
500	0.695	0.815	1600	0.425	0.485
600	0.685	0.805	1700	0.415	0.475
700	0.670	0.790	1800	0.410	0.470
800	0.650	0.770	1900	0.405	0.460
900	0.640	0.765	2000	0.400	0.450
1000	0.485	0.550	....	.....	.....

VALUES OF (a)			CORRESPONDING a	
Teeth in engaging gears	Single tooth engages	Single tooth engages	Brown & Sharpe 14½-deg. involute	Fellows 20-deg. involute stub tooth
			1.00	1.00
12	12	12	1.10	1.13
20	20	30	1.15	1.20
30	30	30	1.47	1.22
40	40	40	1.60	1.24
60	60	60	1.60	1.25
80	80	80	1.60	1.26
100	100	100	1.60	1.27
120	120	120	1.60	1.29
140	140	140	1.60	1.31
160	160	160	1.60	1.33

[G. H. Marx and L. E. Cutter. *Trans.*, vol. 37, p. 503]

MECHANICAL ENGINEERING DATA

LAPS AND LAPPING

The values in Table 1 represent 15 best results out of 63 combinations.

TABLE 1 COMPARATIVE VALUES OF THE BEST COMBINATIONS, TAKING EMERY-CAST IRON LAP AND MACHINE OIL AS UNITY

Carborundum—Steel lap	Lard oil	3.52
Carborundum—Copper lap	Lard oil	3.44
Carborundum—Cast lap	Gasoline	3.42
Alundum—Copper lap	Soda water	3.39
Carborundum—Cast lap	Turpentine	3.37
Carborundum—Cast lap	Alcohol	3.35
Alundum—Cast lap	Gasoline	3.25
Carborundum—Copper lap	Turpentine	3.22
Carborundum—Cast lap	Kerosene	3.20
Carborundum—Copper lap	Soda water	3.19
Carborundum—Steel lap	Machine oil	3.17
Alundum—Copper lap	Turpentine	3.15
Carborundum—Copper lap	Machine oil	3.14
Alundum—Copper lap	Alcohol	3.10
Carborundum—Copper lap	Alcohol	3.09

TABLE 2 RESULTS OF TESTS ON DRY LAPPING

		Revolutions			
		100	200	300	500
	Lap	Milligrams ground from specimen			
Carborundum No. 150, lap charged by rolling	Cast	3.6	6	7.6	8.6
	Steel	10.3	13	15.3	16.6
	Copper	11.3	16.3	19	23.3
	Tin	18.6	25.6	30.6	39
Carborundum No. 150, lap charged by rubbing	Cast	2	3.3	4	5
	Steel	6.6	8.6	9.6	11
	Copper	6.6	9.6	11.6	13.6
	Tin	7.3	10.3	12.3	15.3
Carborundum "F," lap charged by rolling	Cast	8.6	12.6	14.6	16.6
	Steel	6.3	8.3	9.3	10.6
	Copper	6	8	9.6	11
	Tin	7	9.3	10.3	12
Carborundum "F," lap charged by rubbing	Cast	2.6	5	6	7
	Steel	5	7	8	9
	Copper	3	5	6.6	8.6
	Tin	2	4	5	5.3

379

TABLE 3 COMPARISON OF WET AND DRY LAPPING: PRESSURE, 15 LB.; ABRASIVE, CARBORUNDUM; 100 REV. OF MACHINE

	Best results with			
	Cast lap	Steel lap	Copper lap	Tin lap
Wet.....	20	24	22	...
Dry.....	8.6	10.3	11.3	18.6

The main facts, as developed by the investigations and deductions therefrom, are summarized as follows:

- a* The initial rate of cutting is not greatly different for the different abrasives.
- b* Carborundum maintains its rate better than either of the others, alundum next, and emery the least.
- c* Carborundum wears the lap about twice as fast, and alundum $1\frac{1}{4}$ times as fast as emery.
- d* There is no advantage in using an abrasive coarser than No. 150.
- e* The rate of cutting is practically proportional to the pressure.
- f* The wear of the laps is in the following proportions:

Cast iron, 1.00	Steel, 1.27	Copper, 2.62
-----------------	-------------	--------------
- g* This wear is inversely proportional to the hardness by the Brinell test.
- h* In general, copper and steel cut faster than cast iron, but where permanence of form is a consideration, cast iron is the superior metal.

[*W. A. Knight and A. A. Case. Trans., vol. 37, p. 297*]

EFFECT OF RELATIVE HUMIDITY ON LEATHER BELTS

If a belt be set up at low relative humidity, slipping will probably occur if the relative humidity increases to any great extent, especially if accompanied by a rise in temperature.

380

If a belt be set up at high relative humidity, excessive pressure on the bearings and stretching of the belt will result from a decided decrease in relative humidity, especially if accompanied by a fall in temperature.

If a belt be set up at a medium relative humidity, the tensions will not be excessive at lower relative humidities, nor will there be any great danger of slipping at high relative humidities unless accompanied by excessive temperature changes. In other words, the factor of safety in the ordinary belt rules is sufficient to take care of the effect of changes in the relative humidity if the set up be made at a medium per cent of relative humidity.

If a belt be set up at any relative humidity with a spring or gravity tightener, a load 50 per cent greater than the standard can be transmitted at either high or low humidity without danger of stretching the belt, slipping, or excessive pressure on the bearings.

[*W. W. Bird and F. W. Roys. Trans., vol. 37, p. 129*]

FORMULA FOR THE COMPARISON OF GASOLINE AUTOMOBILE PERFORMANCES

The vehicle coefficient of a gasoline automobile is

$$VC = \frac{8.4nb^3sR}{DW} \quad [1]$$

where n = number of cylinders; b = bore in inches; s = stroke in inches; R = gear reduction; D = diameter of driving tires in inches; W = total weight of vehicle and load in pounds.

In addition, VC is multiplied by e_m , which represents the efficiency of the motor compared with the N.A.C.C. rating as unity, and also by e_t , which represents the efficiency of the transmission system, so that the formula becomes

$$VC = \frac{8.4nb^3sR}{DW} e_m e_t \quad [2]$$

VC is the ratio of the effort in pounds which the motor can exert at the driving tires to the total weight in pounds to be moved. If multiplied by the weight W , it will give the actual propelling force in pounds exerted at the tires of the driving wheels. VC is the measure of the ability of the motor vehicle to propel itself. It represents the very important interrelation of the motor displacement, the gear reduction, the diameter of the driving wheels, and the total weight to be moved.

The product of the terms e_m and e_t for the average well-built car will be about 95 per cent. If this factor be used, formula [2] becomes

$$VC = \frac{8nb^3sR}{DW} \quad [3]$$

[*Journal, September, 1915, p. 563*]

[Source: *Bulletin, Society of Automobile Engineers, July, 1915*]

RESISTANCE TO ROLLING OF A HARD BODY OVER A PLASTIC SURFACE

Formula for expressing the specific resistance f (in kg. per sq. cm.) of the ground to crushing:

$$f = f_0 \cdot y$$

where f_0 (in kg. per cu. cm.) is a coefficient of specific resistance of the ground to crushing, that is, the load in kg. per 1 sq. cm. of surface of ground which causes permanent deformation of the ground to a depth of 1 cm. This formula shows that the specific resistance of the ground to crushing is proportional to the depth of the permanent deformation or crushing which corresponds to it.

When a caterpillar having a chain B cm. wide rolls over soft ground, the total work of deformation is equal to

$$R = \frac{F_0 \cdot y_0^2}{2} \cdot B$$

where y is the depth of compression of the ground in cm. and F_0 is to be found from the formula for specific work of deformation

$$\int_0^{y_0} F_0 \cdot y_0 dy = F_0 \frac{y_0}{2}$$

which is the specific work of deformation in kg. per cm.

In the case of a chain of the caterpillar type rolling along a roadside, the coefficient of resistance to rolling increases in proportion to the load, while the resistance to rolling of the chain increases in proportion to the square of the load. Hence, it is very inadvisable to overload the chain.

The resistance due to friction in the journal of the wheels of the wagon may be expressed by the following formula:

$$R_0 = \mu \frac{d}{D} \cdot Q$$

where R_0 is a braking force in kg. applied horizontally to the axis of the wheel, d is the diameter of the journal of the shaft, D the diameter of the driven wheel, Q the load on the shaft in kg., and μ the coefficient of friction on the surface of the journal.

According to the investigation made by the author the diameter d of the journal does not exceed in the case of heavy trucks 60–80–100 mm., and for lighter wagons 40–50 mm., so that the ratio d/D does not usually reach 0.110 and does not fall below 1/30, being on the average approximately 1/20.

382

Equations which give a general and analytical solution of the problem of resistance to rolling of a driven wheel with a hard cylindrical rim, moving along a plastic roadway, this solution being independent of the law of resistance of the ground to deformation, are as follows:

$$R = B \int_0^{y_0} F \cdot dy$$

$$Q = B \int_0^{x_0} F \cdot dx$$

Theoretically, therefore, the problem can always be solved, no matter what it is, by the experimental law of resistance of the ground to the deformation.

[*Journal, August, 1915, pp. 478 and 555*]

[Source: *Proceedings, Imperial Russian Technical Society* (in Russian), vol. 49 (1915), p. 81]

PROPERTIES OF STEAM-PIPE COVERINGS

The loss per square foot of outside surface of steam-pipe coverings can be expressed mathematically only by a transcendental equation which does not admit of a ready solution. Tests have shown that the rate of heat loss from a sur-

face in contact with air depends upon the character of the surface and the temperature difference between the surface and the air, and not directly upon the conductivity of the material beneath the surface. In its turn the temperature difference referred to above depends upon the conductivity, since the heat that is lost must come through the covering; therefore, the temperature of the surface will be maintained at some point just high enough above the room temperature to bring about the dissipation of the given amount of heat. The character of the material of the covering affects the amount of heat that will pass through it only in as far as the temperature difference between the surface of the covering and the surrounding air will be higher for the one losing the greater amount of heat, and *vice versa*. What a pipe contains makes absolutely no difference in the amount of heat lost, provided the temperature of the pipe surface is the same in each case.

[*L. B. McMillan. Trans., vol. 37, p. 921*]

DIRECTORY SECTION

**Mechanical Equipment
Directory**

385

Pages 387-500

IN this edition of the Condensed Catalogues, the Mechanical Equipment Directory takes complete form as a reference list covering the entire field of mechanical equipment.

In compiling the Directory every care has been taken to insure both comprehensiveness and accuracy in the subject headings, as well as in the proper classification of the firm names listed thereunder.

While the Society maintains extensive records concerning the various manufacturing concerns, these were not relied upon as the sole basis for compilation of the Directory. Verification was therefore made in every instance; and no firm was listed until a statement covering the items of its manufacture had been furnished to the Society. Any omissions that may have occurred are due in practically every case to failure on the part of the firm in question to supply the verification requested.

The Mechanical Equipment Directory is especially designed to meet the ready-reference needs of the mechanical engineer, and is the only comprehensive reference list in existence devoted exclusively to mechanical equipment and supplies. Containing as it does the names and addresses of over 2500 manufacturers, classified under more than 2000 different subject headings, the Directory will be found indispensable as a means of locating readily the sources of supply of any given class of equipment marketed in this field.

MECHANICAL EQUIPMENT DIRECTORY

A

ABRASIVE MATERIALS

Carborundum Co., Niagara Falls, N. Y.

See page 248

Norton Co., Worcester, Mass. *See page 249*

ABRASIVE WHEELS

(See Grinding Wheels)

ACCUMULATORS

*Alliance Machine Co., Alliance, O. *See page 188*

Burroughs Co., Charles, 141-149 Commerce St., Newark, N. J.

Elmes Engineering Works, Charles F., 215 N. Morgan St., Chicago, Ill.

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Worthington Pump & Mchy. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

ACETYLENE APPARATUS

Milburn Co., Alexander, 1420-1426 W. Baltimore St., Baltimore, Md.

ACETYLENE GAS

Carbic Mfg. Co., West Duluth, Minn.

Frest-O-Lite Co., Inc., Indianapolis, Ind.

AERIAL TRAMWAYS

(See Tramways, Wire Rope)

AGITATORS

Dorr Co., 1009 17th St., Denver, Colo.

Steam Jacketed

Sowers Mfg. Co., 1298-1310 Niagara St., Buffalo, N. Y.

AGRICULTURAL MACHINERY

American Arbor Machine Co., Ann Arbor, Mich.

Buffalo Pitts Co., Carolina & Fourth Sts., Buffalo, N. Y.

Holt Mfg. Co., Stockton, Cal.

International Harvester Co. of America, Harvester Bldg., Chicago, Ill.

Universal Hoist & Mfg. Co., Cedar Falls, Ia.

Wood M. & R. M. Co., Walter A., Hoosick Falls, N. Y.

AIR BRAKES, COMPRESSORS, SEPARATORS, ETC.

(See Brakes, Compressors, Separators, Etc., Air)

AIR CONDITIONING APPARATUS

American Blower Co., Detroit, Mich. *See pages 280, 281*

Carrier Air Conditioning Co., 490 Broadway, Buffalo, N. Y.

Carrier Engineering Corp'n, 39 Cortlandt St., New York, N. Y.

Cramer, Stuart C., Charlotte, N. C.

Dicks, Slosson Co., Inc., 302 Broadway, New York, N. Y.

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

AIR LIFT PUMPING SYSTEMS

Indiana Air Pump Co., 812 Indiana Pythian Bldg., Indianapolis, Ind.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

Worthington Pump & Mchy. Corp'n (Laidlaw Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

AIR LIFTS

France Packing Co., 6550 State Road, Tacony, Philadelphia, Pa.

AIR PURIFYING APPARATUS

American Blower Co., Detroit, Mich. *See pages 280, 281*

Dicks, Slosson Co., Inc., 302 Broadway, New York, N. Y.

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

AIR TANKS AND CYLINDERS

(See Receivers, Air)

AIR WASHERS

American Blower Co., Detroit, Mich. *See pages 280, 281*

American Spray Co., 26 Cortlandt St., New York, N. Y.

Bicalky Fan Co., 866 Prospect Ave., Buffalo, N. Y.

Carrier Air Conditioning Co., 490 Broadway, Buffalo, N. Y.

Carrier Engineering Corp'n, 39 Cortlandt St., New York, N. Y.

New York Blower Co., East Orange, N. J.

*Spray Engineering Co., 93 Federal St., Boston, Mass. *See page 87*

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

ALARM WATER COLUMNS

(See Water Columns, Alarm)

ALLOYS

Allen & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

American Bronze Co., Berwyn, Pa. *See pages 198, 199*

American Vanadium Co., 316 Frick Bldg., Pittsburgh, Pa.

Bayonne Casting Co., Bayonne, N. J.

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Damascus Bronze Co., 928 South Ave., Pittsburgh, Pa.

*Doehler Die-Casting Co., Brooklyn, N. Y. *See page 263*

Goldschmidt Thermit Co., 120 Broadway, New York, N. Y.

Leddell Metals Co., 285 Border Ave., Long Island City, N. Y.

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

ALTERNATORS

(See Generators, Electric)

ALUMINUM CASTINGS, WIRE, ETC.

(See Castings, Wire, etc., Aluminum)

ALUMINUM (Ingot, Sheet)

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

ALUNDUM

(See Abrasive Materials)

AMMETERS

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*

Brown Instrument Co., Philadelphia, Pa. *See page 328*

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Abr

See Catalogue Section for data of firms listed in bold face type

AMMETERS (continued)

Pignolet, Louis M., 78 Cortlandt St., New York, N. Y.
 *Weston Electrical Instrument Co., Waverly Park, Newark, N. J. *See page 333*

AMMONIA

Anhydrous

National Ammonia Co., St. Louis, Mo.

Aqua

National Ammonia Co., St. Louis, Mo.

AMMONIA APPARATUS (Aqua)

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

AMMONIA CONDENSERS, FITTINGS, ETC.
 (See Condensers, Fittings, etc., Ammonia)

ANALYTICAL APPARATUS

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*
 Elmer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

ANCHORS, EXPANSION

Brohard Co., 3rd St. & Lehigh Ave., Philadelphia, Pa.
 Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*
 National Lead Co., 111 Broadway, New York, N. Y. *See pages 260, 261*
 Star Expansion Bolt Co., 147-149 Cedar St., New York, N. Y.

ANEMOMETERS

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*

ANNEALING

American Metal Treatment Co., Elizabeth, N. J.

ANTI-FRICTION METALS

(See Metals, Anti-Friction)

ANVILS

Hay-Budden Mfg. Co., 254 N. Henry St., Brooklyn, N. Y.

Arbor PRESSES

(See Presses, Arbor)

ARCH PROTECTORS, BOILER

Lamprey Co., 43 Broad St., Westfield, Mass.

ARCHES

Boiler

Detrick Co., M. H., 549 W. Washington St., Chicago, Ill.
 Pliable Fire Brick Co., 133 W. Washington St., Chicago, Ill.
 McLeod & Henry Co., Troy, N. Y.
 Monarch Boiler Arch Co., 629-630 Wells Bldg., Milwaukee, Wis.
 Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*
 Woolson, Orosco C., 39 Cortlandt St., New York, N. Y.

Fire Door

Monarch Boiler Arch Co., 629-630 Wells Bldg., Milwaukee, Wis.
 Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Ignition (Flat, Suspended)

Detrick Co., M. H., 549 W. Washington St., Chicago, Ill.

*Green Engineering Co., East Chicago, Ind. *See pages 64, 65*

Rear Combustion Chamber

Monarch Boiler Arch Co., 629-630 Wells Bldg., Milwaukee, Wis.
 Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Sectional (Locomotive)

American Arch Co., McCormick Bldg., Chicago, Ill.

ASBESTOS PRODUCTS

Acme Asbestos Covering & Supply Co., 401 N. Ada St., Chicago, Ill.

Carey Co., Philip, Cincinnati, O. *See page 121*
 Central Asbestos & Magnesia Co., 214-216 W. Grand Ave., Chicago, Ill.
 Franklin Mfg. Co., Franklin, Pa. *See page 121*

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Keasbey Co., Robert A., West & Bank Sts., New York, N. Y.

Keasbey & Mattison Co., Ambler, Pa. *See page 121*

Kern Commercial Co., 114 Liberty St., New York, N. Y.

Richards-Wilson Pipe Covering Co., 325 Scribner Ave., Grand Rapids, Mich.

Sall Mountain Co., 230 S. La Salle St., Chicago, Ill.

ASH HANDLING SYSTEMS (Steam Jet)

Girtanner-Davies Eng. & Contg. Co., 504 Chemical Bldg., St. Louis, Mo.

*Green Engineering Co., East Chicago, Ind. *See pages 64, 65*

Griffin Engineering and Construction Co., Elkhart, Ind.

ASPHALT HEATERS

(See Heaters, Asphalt)

ASSAY APPARATUS

Elmer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

AUTOMOBILE BODY MACHINERY

Pettingell Machine Co., Amesbury, Mass.
 Yoder Co., 1024 B. of L. E. Bldg., Cleveland, O.

AUTOMOBILE PARTS

Babson-Dow Mfg. Co., 60 Fulda St., Roxbury Station, Boston, Mass.

Phillips Mfg. Co., R. B., 3 Grand St. Ct., Worcester, Mass.

Sabin Machine Co., Cleveland, O.

Salisbury Ball Bearing Corp'n, Jamestown, N. Y.

Standard Welding Co., W. 73rd & N. Y. C. Tracks, Cleveland, O.

Pressed Steel

Worcester Pressed Steel Co., Worcester, Mass.

AXLES

Cross Gear & Engine Co., 800-806 Bellevue Ave., Detroit, Mich.

Empire Axle Co., Dunkirk, N. Y.

Commercial Car

Celfor Tool Co., Buchanan, Mich.

Timken-Detroit Axle Co., 136-210 Clark Ave., Detroit, Mich.

Pleasure Car

Jacobson Machine Mfg. Co., Warren, Pa.

Liggett Spring & Axle Co., Monongahela, Pa.

Timken-Detroit Axle Co., 136-210 Clark Ave., Detroit, Mich.

Car and Locomotive

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 69*

Pittsburgh Forge & Iron Co., 1003 Penn Ave., Pittsburgh, Pa.

B

BABBITT METAL

Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

Cadman Mfg. Co., A. W., 2814-2816 Smallman St., Pittsburgh, Pa.

Damascus Bronze Co., 928 South Ave., Pittsburgh, Pa.

Empire Metal Co., Syracuse, N. Y.

Frictionless Metal Co., Chattanooga, Tenn.

Leddell Metals Co., 285 Border Ave., Long Island City, N. Y.

Lubricating Metal Co., 2 Rector St., New York, N. Y.

Lumen Bearing Co., Buffalo, N. Y. *See page 201*
Magnolia Metal Co., 113-115 Bank St., New York, N. Y.
Merchant & Evans Co., 2019-2035 Washington Ave., Philadelphia, Pa.
Murphy Metals Co., 1248 Webster Bldg., Chicago, Ill.
National Lead Co., 111 Broadway, New York, N. Y.
Riverside Metal Refining Co., Connellsville, Pa.
United Lead Co., 111 Broadway, New York, N. Y. *See page 202*
BACTERIOLOGICAL APPARATUS
Elmer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*
BAG FILLING MACHINES
Brown Bag Filling Machine Co., Fitchburg, Mass.
BAG MAKING MACHINES
Brown Bag Filling Machine Co., Fitchburg, Mass.
BAKERS' MACHINERY
Ruger Mfg. Co., J. W., 222 Chicago St., Buffalo, N. Y.
BALANCE INDICATING MACHINES, RUNNING
Norton Grinding Co., Worcester, Mass.
BALANCES, SPRING
Chatillon & Sons, John, 85-93 Cliff St., New York, N. Y. *See page 315*
BALANCES AND WEIGHTS
American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*
Becker, Inc., Christian, 92 Reade St., New York, N. Y.
Central Scientific Co., 460 E. Ohio St., Chicago, Ill.
Elmer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*
Torsion Balance Co., 92 Reade St., New York, N. Y.
BALL BEARINGS, CRANKS, GAGES, MILLS, ETC.
(See Bearings, Cranks, Gages, Mills, etc., Ball)
BALL CUPS, PRESSED STEEL
Worcester Pressed Steel Co., Worcester, Mass.
BALLS
Brass and Bronze
Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y. *See page 154*
Draper Mfg. Co., Port Huron, Mich.
***Gwilliam Co.**, 253 W. 58th St., New York, N. Y. *See page 160*
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*
Jones Ball Co., Arlington Heights, Mass.
Standard Roller Bearing Co., 5001 Lancaster Ave., Philadelphia, Pa.
Burnishing
Abbott Ball Co., Elmwood, Conn.
Steel
Abbott Ball Co., Elmwood, Conn.
***Atlas Ball Co.**, Glenwood Ave. at 4th St., Philadelphia, Pa. *See page 159*
Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y. *See page 154*
Ball & Roller Bearing Co., Maple Ave., Danbury, Conn.
***Gwilliam Co.**, 253 W. 58th St., New York, N. Y. *See page 160*
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*
Hoover Steel Ball Co., Ann Arbor, Mich.
Jones Ball Co., Arlington Heights, Mass.
New Departure Mfg. Co., Bristol, Conn. *See page 157*
Tioga Steel & Iron Co., Philadelphia, Pa.

Steel, Reground
***Ahlberg Bearing Co.**, 2636 Michigan Ave., Chicago, Ill.
BALL MILL WEARING PARTS
Chrome Steel Works, Chrome, N. J.
BALL WINDING MACHINES
Franklin Machine Co., Providence, R. I.
BAR IRON
American Iron & Steel Mfg. Co., Lebanon, Pa.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa. *See page 258*
Pittsburgh Forge & Iron Co., 1003 Penn Ave., Pittsburgh, Pa.
St. Louis Screw Co., St. Louis, Mo.
BAR MACHINES (Heavy Duty)
International Machine Tool Co., Indianapolis, Ind.
BAR STEEL
Interstate Iron & Steel Co., Chicago, Ill.
BARS
Merchant
Lackawanna Steel Co., Lackawanna, N. Y.
Reinforcing (Concrete Work)
Interstate Iron & Steel Co., Chicago, Ill.
BAROMETERS
American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*
Green, Henry J., 1191 Bedford Ave., Brooklyn, N. Y.
Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*
BAROMETRIC CONDENSERS
(See Condensers, Barometric)
BARREL SWINGS
Leavitt Machine Co., Orange, Mass.
BARRELS (Metal)
Butler Mfg. Co., Kansas City, Mo.
Cleveland Wire Spring Co., Cleveland, O.
***Scaife & Sons Co.**, Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*
BATTERIES, STORAGE
Edison Storage Battery Co., Orange, N. J.
Electric Storage Battery Co., Allegheny Ave. & 19th St., Philadelphia, Pa.
Prest-O-Lite Co., Inc., Indianapolis, Ind.
U. S. Light & Heat Corp'n, Niagara Falls, N. Y.
BEARING METALS
(See Metals, Bearing)
BEARING TESTING MACHINES
Olsen Testing Machine Co., Tinlus, 500 N. 12th St., Philadelphia, Pa. *See page 312*
Richlé Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*
BEARINGS
Babbitt (Die Cast)
Franklin Mfg. Co., H. H., 730 Gifford St., Syracuse, N. Y.
Muzzy-Lyon Co., Ltd., Detroit, Mich.
Stewart Mfg. Co., Wells St., Bridge, Chicago, Ill.
Ball
***Ahlberg Bearing Co.**, 2636 Michigan Ave., Chicago, Ill.
American Ball Co., Providence, R. I.
Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y. *See page 154*
Ball & Roller Bearing Co., Maple Ave., Danbury, Conn.
Bearings Co. of America, Lancaster, Pa.
***Fafnir Bearing Co.**, New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
G-A Ball Bearing Mfg. Co., 123-141 N. Albany Ave., Chicago, Ill.
Gurney Ball Bearing Co., Jamestown, N. Y. *See page 155*
***Gwilliam Co.**, 253 W. 58th St., New York, N. Y. *See page 160*

Bea

See Catalogue Section for data of firms listed in bold face type

BEARINGS (continued)

Ball

- Hess-Bright Mfg. Co., Philadelphia, Pa. *See page 156*
 Imperial Bearing Co., Detroit, Mich.
 Matthews Mfg. Co., Worcester, Mass.
 New Departure Mfg. Co., Bristol, Conn. *See page 157*
 Nice Ball Bearing Co., Land Title Bldg., Philadelphia, Pa.
 *Norma Co. of America, 1790 Broadway, New York, N. Y. *See page 158*
 R. I. V. Co., 254 W. 57th St., New York, N. Y.
 S. K. F. Ball Bearing Co., Hartford, Conn.
 Salisbury Ball Bearing Corp'n, Jamestown, N. Y.
 Schafer Ball Bearings Co., Inc., 1790 Broadway, New York, N. Y.
 Schatz Mfg. Co., Poughkeepsie, N. Y.
 Standard Machinery Co., Auburn, R. I.
 Standard Roller Bearing Co., 5001 Lancaster Ave., Philadelphia, Pa.
 Suspension Bearing Co., Spartanburg, S. C.
 Transmission Ball Bearing Co., Inc., 32 Wells St., Buffalo, N. Y.
 U. S. Ball Bearing Mfg. Co., Oak Park, Ill.

Ball (Reground)

- *Ahlberg Bearing Co., 2636 Michigan Ave., Chicago, Ill.

Bronze

- Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.
 Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*
 American Brass Co., Waterbury, Conn. *See page 204*
 Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*
 Damascus Bronze Co., 928 South Ave., Pittsburgh, Pa.
 *Doehler Die-Casting Co., Brooklyn, N. Y. *See page 263*
 Lumen Bearing Co., Buffalo, N. Y. *See page 201*
 Muzzy-Lyon Co., Ltd., Detroit, Mich.

Graphite

- Randall Graphite Sheet Lubricator Co., 816-818 W. Lake St., Chicago, Ill.

Oilless

- Arguto Oilless Bearing Co., Wayne Junction, Philadelphia, Pa.
 Metaline Co., West Ave. near Borden, Long Island City, N. Y.

Roller

- Accurate Engineering Co., Chicago, Ill.
 American Roller Bearing Co., Pittsburgh, Pa.
 Ball & Roller Bearing Co., Maple Ave., Danbury, Conn.
 George Automatic Roller Bearing Co., 4614 Spring Grove Ave., Cincinnati, O.
 *Gwilliam Co., 253 W. 58th St., New York, N. Y. *See page 160*
 Hyatt Roller Bearing Co., Box 476, Newark, N. J.
 Makutchan Roller Bearing Co., 1542 McCormick Bldg., Chicago, Ill.
 *Norma Co. of America, 1790 Broadway, New York, N. Y. *See page 158*
 Railway Roller Bearing Co., Syracuse, N. Y.
 *Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*
 Standard Machinery Co., Auburn, R. I.
 Standard Roller Bearing Co., 5001 Lancaster Ave., Philadelphia, Pa.
 Suspension Bearing Co., Spartanburg, S. C.

Self-oiling

- *Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 130*
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

- *Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*
 Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*
 *Falls Clutch & Machinery Co., Cuyahoga Falls, O. *See page 143*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Medart Patent Pulley Co., St. Louis, Mo.
 Nordyke & Marmon Co., Indianapolis, Ind.
 *Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*
 *Wood's Sons Co., T. B., Chambersburg, Pa. *See pages 150, 151*

Thrust

- Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*
 Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y. *See page 154*
 *Fafnir Bearing Co., New Britain, Conn.
 G-A Ball Bearing Mfg. Co., 123-141 N. Albany Ave., Chicago, Ill.
 Gurney Ball Bearing Co., Jamestown, N. Y. *See page 155*
 *Gwilliam Co., 253 W. 58th St., New York, N. Y. *See page 160*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 *Norma Co. of America, 1790 Broadway, New York, N. Y. *See page 158*
 S. K. F. Ball Bearing Co., Hartford, Conn.
 Suspension Bearing Co., Spartanburg, S. C.
 U. S. Ball Bearing Mfg. Co., Oak Park, Ill.

BEDS, RUBBING

- Flory Mfg. Co., S., Bangor, Pa.

BELT ADJUSTERS

- Cleveland Fabric Belting Co., 1473 W. 110th St., Cleveland, Ohio.

BELT CONVEYORS

- (See Conveyors, Belt)

BELT DRESSING

- Arrow Boiler Compound Co., 703-715 Roe Bldg., St. Louis, Mo.
 Bradford Belting Co., Cincinnati, O.
 Chesapeake Belting Co., 813-823 Homewood Ave., Baltimore, Md.
 Cling Surface Co., Buffalo, N. Y.
 Desmond-Stephan Mfg. Co., Urbana, O.
 Gandy Belting Co., Baltimore, Md.
 Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*
 Hudson Belting Co., Worcester, Mass.
 Kramer Oil Co., W. J., Milwaukee, Wis.
 Ladew Co., Inc., Edward R., Glen Cove, N. Y.
 McCauley Belting Co., 212-220 Orleans St., Chicago, Ill.
 Mount Vernon Belting Co., Baltimore, Md.
 Ranville Co., F., 241-243 Pearl St., Grand Rapids, Mich.
 Sawyer Belting Co., Cleveland, Ohio
 *Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*
 Shultz Belting Co., St. Louis, Mo. *See page 171*
 Watt's Sons, John M., 54 N. 2nd St., Philadelphia, Pa.

BELT FASTENERS

- Clipper Belt Lacer Co., 974-1016 Front Ave. N. W., Grand Rapids, Mich.
 *Flexible Steel Lacing Co., 522 S. Clinton St., Chicago, Ill. *See page 268*
 Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*
 *Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*
 Main Belting Co., Philadelphia, Pa. *See page 167*
 Rossendale-Reddaway Belting & Hose Co., Newark, N. J. *See page 168*

BELT LACERS

- Clipper Belt Lacer Co., 974-1016 Front Ave. N. W., Grand Rapids, Mich.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

BELT LACING

Clipper Belt Lacer Co., 974-1016 Front Ave.,
N. W., Grand Rapids, Mich.
Coe & Brown, New Haven, Conn.
Couse & Bolten, 42-46 Lafayette St., Newark,
N. J.
Graton & Knight Mfg. Co., Worcester, Mass.

See page 166

New York Leather Belting Co., 465 Kent Ave.,
Brooklyn, N. Y.
Palmer & Co., N., Bridgeport, Conn.
Rahmann & Co., Geo., 31 Spruce St., New
York, N. Y.

*Schieren Co., Chas. A., 30-38 Ferry St.,
New York, N. Y. *See page 170*
Williams & Sons, I. B., Dover, N. H.

Hinge

*Bristol Co., Waterbury, Conn. *See page 327*

*Flexible Steel Lacing Co., 522 S. Clinton St.,
Chicago, Ill. *See page 268*

BELT TIGHTENERS

*Brown Co., A. & F., 79 Barclay St., New York,
N. Y. *See page 136*

*Caldwell & Son Co., H. W., 17th St. &
Western Ave., Chicago, Ill. *See page 174*
Dodge Sales & Engineering Co., Mishawaka,
Ind. *See pages 74, 144, 145, 146, 147*

*Hill Clutch Co., Cleveland, O. *See page 148*
Weller Mfg. Co., 1820-1856 N. Kostner Ave.,
Chicago, Ill. *See pages 180, 181, 182*

*Wood's Sons Co., T. B., Chambersburg, Pa.
See pages 150, 151

BELTING**Angular**

Sumner Belting Co., William, Tolland, Conn.

Balata

Chesapeake Belting Co., 813-823 Homewood
Ave., Baltimore, Md.
Dick, Ltd., R. & J., Passaic, N. J.
Victor Balata & Textile Belting Co., 465
Kent Ave., Brooklyn, N. Y.

Camel's Hair

Rossendale-Reddaway Belting & Hose Co.,
Newark, N. J. *See page 168*

Canvas

Acme Belting Co., Niles, Mich.
Chesapeake Belting Co., 813-823 Homewood
Ave., Baltimore, Md.
Gandy Belting Co., Baltimore, Md.
McIlroy Belting & Hose Co., Hammond, Ind.
Mount Vernon Belting Co., Baltimore, Md.
National Leather Belting Co., 342 E. 38th
St., New York, N. Y.
Sawyer Belting Co., Cleveland, Ohio
Victor Balata & Textile Belting Co., 465 Kent
Ave., Brooklyn, N. Y.

Chain Link

(See Chain Belts and Links)

Coiled Wire

McCord Mfg. Co., Detroit, Mich. *See page*
127

Webb Mfg. Co., Foot of Center St., Newark,
N. J.

Conveyor

Acme Belting Co., Niles, Mich.
Boston Belting Co., 84 Linden Park St.,
Boston, Mass. *See page 162*
Dick, Ltd., R. & J., Passaic, N. J.
*Gilmer Co., L. H., Vincent St., Tacony,
Philadelphia, Pa. *See page 164*

*Goodrich Co., B. F., Akron, O. *See pages*
133, 165

Goodyear Tire & Rubber Co., Akron, O.
Imperial Belting Co., Lincoln & Kinzie Sts.,
Chicago, Ill.

Main Belting Co., Philadelphia, Pa. *See page*
167

Manhattan Rubber Mfg. Co., Passaic, N. J.
Mechanical Rubber Co., Cleveland, O. *See*
page 169

*Quaker City Rubber Co., 629 Market St.,
Philadelphia, Pa.

Republic Rubber Co., Youngstown, O.
Stanley Belting Corp'n, 40 S. Clinton St.,
Chicago, Ill.

Victor Balata & Textile Belting Co., 465
Kent Ave., Brooklyn, N. Y.

Weller Mfg. Co., 1820-1856 N. Kostner Ave.,
Chicago, Ill. *See pages 180, 181, 182*

Cotton

Acme Belting Co., Niles, Mich.
Cleveland Fabric Belting Co., 1473 W. 110th
St., Cleveland, Ohio
McIlroy Belting & Hose Co., Hammond,
Ind.
Scandinavia Belting Co., 106-108 Reade St.,
New York, N. Y.

Cotton-leather

Sumner Belting Co., William, Tolland, Conn.

Endless

Acme Belting Co., Niles, Mich.
*Gilmer Co., L. H., Vincent St., Tacony,
Philadelphia, Pa. *See page 164*

Endless (Woven)

*Gilmer Co., L. H., Vincent St., Tacony,
Philadelphia, Pa. *See page 164*

Fabric

Fabreeka Belting Co., Burlington, Va.

Fabric (Leather Faced)

Peerless Belting Co., Buffalo, N. Y.

Hair

Scandinavia Belting Co., 106-108 Reade St.,
New York, N. Y.

Leather

Alexander Brothers, 414 N. 3rd St., Phila-
delphia, Pa.

Bay State Belting Co., 605 Atlantic Ave.,
Boston, Mass.

Bickford & Francis Belting Co., Buffalo, N. Y.

Bond Co., Charles, Philadelphia, Pa.
Bonner & Burnewall, Inc., 30 Church St.,
New York, N. Y.

Bradford Belting Co., Cincinnati, O.
Burr Oak Belting Co., 521 Livingston St.,
Cincinnati, O.

Central Belting Co., 151 Lafayette St., New
York, N. Y.

Chicago Belting Co., 113-125 N. Green St.,
Chicago, Ill.

Coe & Brown, New Haven, Conn.

Consolidated Belting Co., 2 Jeffrey St.,
Chester, Pa.

Cook Belting Co., H. N., San Francisco, Cal.
See page 163

Couse & Bolten, 42-46 Lafayette St., Newark,
N. J.

Covell Belting Co., Philadelphia, Pa.
Cowan & Co., Andrew, 421-423 W. Main St.,
Louisville, Ky.

Cross Bros. & Co., 112-114 Mill St.,
N. Y.

Detroit Oak Belting Co., 260 West
Detroit, Mich.

Druid Oak Belting Co., Inc., Baltimore, Md.

Eagle Counter & Leather Co., 41-43
Eighth St., Cincinnati, O.

Graton & Knight Mfg. Co., Worcester, Mass.
See page 166

Himmlein & Bailey, 234
Philadelphia, Pa.

Holyoke Belting Co., Haverhill, Mass.

Hudson Belting Co., Worcester, Mass.

Jewell Belting Co., Hartford, Conn.

Ladew Co., Inc., Elmer, N. Y.

Laurence Belting Co., New York, N. Y.

McCauley Belting Co., Chicago, Ill.

Bel

See Catalogue Section for data of firms listed in last

BELTING (continued)**Leather**

- Maloney Belting Co., 130 N. Franklin St., Chicago, Ill.
 National Leather Belting Co., 342 E. 38th St., New York, N. Y.
 National Leather Mfg. Co., Niles, Mich.
 New York Leather Belting Co., 465 Kent Ave., Brooklyn, N. Y.
 Norwich Belting Co., Norwich, Conn.
 Olmsted-Plint Co., 624 Main St., Cambridge, Mass.
 Page Belting Co., Concord, N. H.
 Palmer & Co., N., Bridgeport, Conn.
 Provost Engineering Corp'n, Eagle & Provost Sts., Brooklyn, N. Y.
 Rahmann & Co., Geo., 31 Spruce St., New York, N. Y.
 Raniville Co., F., 241-243 Pearl St., Grand Rapids, Mich.
 Rhoads & Sons, J. E., 12 N. Third St., Philadelphia, Pa.
 Rockford Belting Co., Rockford, Ill.
 Salisbury & Co., W. H., 105-107 S. Wabash Ave., Chicago, Ill.
 *Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*
 Schwartz Belting Co., 76 Murray St., New York, N. Y.
 Shackley & Son Co., W. T., 49 High St., Boston, Mass.
 Shultz Belting Co., St. Louis, Mo. *See page 171*
 Sikes Co., S. R., Minneapolis, Minn.
 Smyth-Despard Co., Utica, N. Y.
 Strong & Hery Co., 301-307 State St., Rochester, N. Y.
 Union Belt Co., Fall River, Mass.
 Warren Co., J. F. & W. H., Worcester, Mass.
 Whiting, Henry F., Shattuck St., Lowell, Mass.
 Williams & Sons, I. B., Dover, N. H.

Rawhide

- Shultz Belting Co., St. Louis, Mo. *See page 171*
 Western Rawhide & Belting Co., Milwaukee, Wis.

Round

- Central Belting Co., 151 Lafayette St., New York, N. Y.
 Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*
 New York Leather Belting Co., 465 Kent Ave., Brooklyn, N. Y.
 Shultz Belting Co., St. Louis, Mo. *See page 171*
 Sumner Belting Co., William, Tolland, Conn.
 Western Rawhide & Belting Co., Milwaukee, Wis.

Rubber

- Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
 Boston Woven Hose & Rubber Co., Box 5077, Boston, Mass.
 Consumers Rubber Co., 829 Superior Ave., W., Cleveland, O.
 Eagle Counter & Leather Co., 414-416 E. Eighth St., Cincinnati, O.
 Empire Rubber & Tire Co., Trenton, N. J.
 *Goodrich Co., B. F., Akron, O. *See pages 133, 165*
 Imperial Belting Co., Lincoln & Kinzie Sts., Chicago, Ill.
 Maguire Rubber Co., 30 Church St., New York, N. Y.
 Manhattan Rubber Mfg. Co., Passaic, N. J.
 Mechanical Rubber Co., Chicago, Ill.
 Mechanical Rubber Co., Cleveland, O. *See page 169*
 Mercer Rubber Co., Hamilton Square, Trenton, N. J.
 New Jersey Car Spring & Rubber Co., Jersey City, N. J.
 New York Belting & Packing Co., 91-93 Chambers St., New York, N. Y.

- New York Rubber Co., 84-86 Reade St., New York, N. Y.
 Peerless Rubber Mfg. Co., 31 Warren St., New York, N. Y.
 *Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.
 Revere Rubber Co., Chelsea, Mass.
 Revere Rubber Co., 59 Reade St., New York, N. Y.
 Salisbury & Co., W. H., 105-107 S. Wabash Ave., Chicago, Ill.
 Thermoid Rubber Co., Trenton, N. J.
 Voorhees Rubber Mfg. Co., 18-56 Bostwick Ave., Jersey City, N. J.

Textile

- Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
 *Gilmer Co., L. H., Vincent St., Tacony, Philadelphia, Pa. *See page 164*
 *Goodrich Co., B. F., Akron, O. *See pages 133, 165*
 Main Belting Co., Philadelphia, Pa. *See page 167*
 Mount Vernon Belting Co., Baltimore, Md.
 Rossendale-Reddaway Belting & Hose Co., Newark, N. J. *See page 168*
 Stanley Belting Corp'n, 40 S. Clinton St., Chicago, Ill.

"V" (Leather)

- Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

Waterproof

- Alexander Brothers, 414 N. 3rd St., Philadelphia, Pa.
 Bay State Belting Co., 605 Atlantic Ave., Boston, Mass.
 Burr Oak Belting Co., 521 Livingston St., Cincinnati, O.
 Central Belting Co., 151 Lafayette St., New York, N. Y.
 Chicago Belting Co., 113-125 N. Green St., Chicago, Ill.
 Cook Belting Co., H. N., San Francisco, Cal. *See page 163*
 Couse & Bolten, 42-46 Lafayette St., Newark, N. J.
 Dick, Ltd., R. & J., Passaic, N. J.
 Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*
 Himmelein & Bailey, 248 Chestnut St., Philadelphia, Pa.
 Holyoke Belting Co., Holyoke, Mass.
 Main Belting Co., Philadelphia, Pa. *See page 167*
 Maloney Belting Co., 130 N. Franklin St., Chicago, Ill.
 Peerless Belting Co., Buffalo, N. Y.
 Rhoads & Sons, J. E., 12 N. Third St., Philadelphia, Pa.
 Rossendale-Reddaway Belting & Hose Co., Newark, N. J. *See page 168*
 *Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*
 Shultz Belting Co., St. Louis, Mo. *See page 171*
 Warren Co., J. F. & W. H., Worcester, Mass.

BENCH LEGS

- Garwood Bronze & Iron Works, Garwood, N. J.

- *Hill Clutch Co., Cleveland, O. *See page 148*

BENDING AND STRAIGHTENING MACHINES

- Long & Allstatter Co., Hamilton, O. *See page 213*
 Williams, White & Co., Moline, Ill. *See page 215*

BENDING MACHINES**Eye**

- Williams, White & Co., Moline, Ill. *See page 215*

Hydraulic

- Williams, White & Co., Moline, Ill. *See page 215*

Bel

*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

BENDING ROLLS

(See Rolls, Bending)

BENZOL RECOVERY PLANTS

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

BILLETS, FORGING

Central Iron & Steel Co., Harrisburg, Pa.

BITTS, BOBBIN

Murkland Co., J. W., Barton, Vt.

BLACKSMITHS' MACHINERY

Novelty Iron Works Co., Dyersville, Ia.

BLANKETS, RUBBER

Boston Belting Co., 84 Linden Park St., Boston, Mass. See page 162

BLAST FURNACES, GATES, ETC.

(See Furnaces, Gates, etc., Blast)

BLEACHING MACHINERY

Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. See page 297

BLOCKS

Building (Hollow)

Maurer & Son, Henry, 420 E. 23rd St., New York, N. Y.

Chain Hoisting

(See Hoists, Chain)

Swage

Noyes & Co., B. B., Greenfield, Mass.

Tackle

American Hoist & Derrick Co., St. Paul, Minn.

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. See page 190

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. See pages 186, 187

Leschen & Sons Co., A., St. Louis, Mo.

Macomber & Whyte Rope Co., Kenosha, Wis.

Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

*Roebbling's Sons Co., John A., Trenton, N. J. See page 172

Stuebner Iron Works, C. L., Hancock St. & Vernon Ave., Long Island City, N. Y. See page 196

BLOWERS

Fan

Allington & Curtis Mfg. Co., 402 Holden St., Saginaw, Mich.

American Blower Co., Detroit, Mich. See pages 280, 281

Bicalfy Fan Co., 866 Prospect Ave., Buffalo, N. Y.

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

Chase Turbine Mfg. Co., Orange, Mass.

Clarage Fan Co., Kalamazoo, Mich.

Coe Co., C. T., 10-14 Johnson St., Newark, N. J.

Dixie Mfg. Co., Inc., Baltimore, Md.

Garden City Fan Co., McCormick Bldg., Chicago, Ill.

Green Fuel Economizer Co., 90 West St., New York, N. Y. See page 58

Ils Electric Ventilating Co., 154 Whiting St., Chicago, Ill.

Indiana Fan Co., 40 E. South St., Indianapolis, Ind.

New England Ventilating & Heating Co., 928 Manton Ave., Providence, R. I.

New York Blower Co., East Orange, N. J.

Power Engineering Co., Railway Exchange, Chicago, Ill.

Sterling Blower Co., Hartford, Conn.

Wing Mfg. Co., L. J., 352 W. 13th St., New York, N. Y.

Forge (Electric)

Electric Blower Co., 352 Atlantic Ave., Boston, Mass.

Multi-Stage (Centrifugal)

Organ Power Co., Hartford, Conn.

Pressure

American Blower Co., Detroit, Mich. See pages 280, 281

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Crowell Mfg. Co., 298 Taaffe Place, Brooklyn, N. Y.

*Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill. See page 293

National Standard Co., Niles, Mich.

Nelson Blower & Furnace Co., 11 Elkins St., Boston, Mass.

Organ Power Co., Hartford, Conn.

Piqua Blower Co., Piqua, O.

*Roots Co., P. H. & F. M., Connersville, Ind. See pages 282, 283

Wilbraham-Green Blower Co., Pottstown, Pa.

Rotary

Beach-Russ Co., 220 Broadway, New York, N. Y.

Connersville Blower Co., Connersville, Ind.

*Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill. See page 293

Piqua Blower Co., Piqua, O.

*Roots Co., P. H. & F. M., Connersville, Ind. See pages 282, 283

Wilbraham-Green Blower Co., Pottstown, Pa.

York Electric & Machine Co., 30-34 N. Penn St., York, Pa.

Soot

Bayer Steam Soot Blower Co., 2828-2840 LaSalle St., St. Louis, Mo.

Clafin Co., C. A., 161 High St., Boston, Mass.

*Diamond Power Specialty Co., Detroit, Mich. See page 73

General Specialty Co., 291-295 Michigan Ave., Buffalo, N. Y.

Marion Machine Foundry & Supply Co., Marion, Ind.

Monarch Steam Blower Co., Troy, N. Y.

National Boiler Specialties Co., Elgin, Ill.

Simonds & Co., G. L., 230 S. La Salle St., Chicago, Ill.

Vulcan Soot Cleaner Co., DuBois, Pa.

Steam Jet

Bloomsburg & Co., H., 425 N. Carey St., Baltimore, Md.

Coe Co., C. T., 10-14 Johnson St., Newark, N. J.

Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

McClave-Brooks Co., Scranton, Pa.

Sauer Power Generating Co., 5115-19 Rosetta St., Pittsburgh, Pa.

U. S. Rocking Grate Bar Co., 20 W. Jackson St., Chicago, Ill.

BLOWOFF PIPE PROTECTORS

Mather Co., E., 204 Walnut St., Harrisburg, Pa.

BLOWPIPES

Buffalo Dental Mfg. Co., 587-589 Main St., Buffalo, N. Y.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. See page 306

Selas Co., 521 W. 23rd St., New York, N. Y. See page 267

Cutting

Delcampe Welding Co., Bridgeport, Conn.

Oxy-Acetylene

Henderson-Willis Welding & Cutting Co., 2305-7-9 N. 11th St., St. Louis, Mo.

Welding

Delcampe Welding Co., Bridgeport, Conn.

Welding and Cutting

Waterhouse Welding Co., Boston, Mass.

Oxy-Carbi Co., New Haven, Conn.

Blo

See Catalogue Section for data of Arms listed in bold face type

BLUE PRINTING MACHINES

Pease Co., C. F., 218 Institute Place, Chicago, Ill.
 Wagenhorst & Co., J. H., 704 Dollar Bank Bldg., Youngstown, O.
 Wickes Bros., 512 Water St., Saginaw, Mich.

BLUING

American Metal Treatment Co., Elizabeth, N. J.

BOILER ARCHES, COVERINGS, FEEDERS, FURNACES, TUBES, ETC.

(See Arches, Coverings, Feeders, Furnaces, Tubes, Etc., Boiler)

BOILER CLEANERS

Buckeye Boiler Skimmer Co., 519-523 Colburn St., Toledo, O.

Mechanical

Dallett Co., Thos. H., Broad & Federal Sts., Philadelphia, Pa.
 National Boiler Specialties Co., Elgin, Ill.

BOILER FRONTS

Kelly Foundry & Machine Co., E. Purl St., Goshen, Ind.
 Myerstown Foundry & Mfg. Co., Inc., 90 West St., New York, N. Y.
 Washburn & Granger, 50 Church St., New York, N. Y. See page 72

BOILER METAL TREATMENT

International Boiler Compound Co., 144 W. Austris Ave., Chicago, Ill.
 Mechanical Scale Prevention Co., 150 Nassau St., New York, N. Y.
 North American Chemical & Engineering Co., 23 Old Slip, New York, N. Y.
 Permutit Co., 30 E. 42nd St., New York, N. Y.
 Perolin Co. of America, 1112 W. 32nd St., Chicago, Ill.
 Standard Chemical Co., Kalamazoo, Mich.

BOILER SETTINGS

Heinicke, Inc., H. R., 147 Fourth Ave., New York, N. Y.

Steel Cased

Casey-Hedges Co., Chattanooga, Tenn. See pages 42, 43
 Cole Mfg. Co., R. D., Newnan, Ga.
 Houston, Stanwood & Gamble Co., Cincinnati, O. See pages 46, 47
 Muskegon Boiler Works, Muskegon, Mich.
 *Wickes Boiler Co., Saginaw, Mich. See page 57

BOILER WASHING SYSTEMS (Locomotive)

National Boiler Washing Co., 531 Railway Exchange Bldg., Chicago, Ill.
 Rue Mfg. Co., 228 Cherry St., Philadelphia, Pa.

BOILERS**Heating**

American Radiator Co., Chicago, Ill.
 Brownell Co., Dayton, O.
 Fitzgibbons Boiler Co., E. 10th & Mercer Sts., Oswego, N. Y.
 Gem City Boiler Co., Dayton, O.
 Gorton & Lidgerwood Co., 96 Liberty St., New York, N. Y.
 Granger Co., A. D., 90 West St., New York, N. Y.
 Gurney Heater Mfg. Co., 200 Franklin St., Boston, Mass.
 Hudson Boiler Mfg. Co., 359 W. 42nd St., New York, N. Y.
 Illinois Malleable Iron Co., 1801 Diversey Parkway, Chicago, Ill.
 Kewanee Boiler Co., Kewanee, Ill.
 Lord & Burnham Co., Irvington on Hudson, New York, N. Y.
 Molby Boiler Co., Inc., 101 Park Ave., New York, N. Y.
 Nagle Engine & Boiler Works, Erie, Pa.
 New York Central Iron Works Co., Inc., Hagerstown, Md.
 Oil City Boiler Works, Oil City, Pa.

Richardson & Boynton Co., Dover, N. J.
 Royal Steam Heater Co., 499 Main St., Gardner, Mass.

*Smith Co., H. B., Westfield, Mass. See pages 308, 309

United States Radiator Corp'n, Detroit, Mich.

High Pressure

*Power Specialty Co., 111 Broadway, New York, N. Y.
 Talbot Boiler Co., 120-122 Liberty St., New York, N. Y.
 Winslow Safety High Pressure Boiler Co., 4600 W. Harrison St., Chicago, Ill.

Internal Furnace

*Bigelow Co., 76 River St., New Haven, Conn. See page 40

Casey-Hedges Co., Chattanooga, Tenn. See pages 42, 43

*Connelly Boiler Co., D., Cleveland, O.
 Farquhar Co., Ltd., A. B., York, Pa.
 Fitzgibbons Boiler Co., E. 10th & Mercer Sts., Oswego, N. Y.
 Freeman & Sons Mfg. Co., S., Racine, Wis.
 Gem City Boiler Co., Dayton, O.
 Granger Co., A. D., 90 West St., New York, N. Y.

International Engineering Works, Ltd., Framingham, Mass.

Kingsford Foundry & Machine Works, Oswego, N. Y.

Manitowoc Shipbuilding Co., Manitowoc, Wis.

Murray Iron Works Co., Burlington, Ia. See page 16

Pennsylvania Boiler Works, Erie, Pa.
 Phoenix Iron Works Co., Meadville, Pa. See page 53

Reliance Boiler Works, Oshkosh, Wis.
 Smith & Son Co., Sam'l, Paterson, N. J.

*Springfield Boiler & Mfg. Co., Springfield, Ill. See page 54

Locomotive

Ames Iron Works, Oswego, N. Y.
 *Bigelow Co., 76 River St., New Haven, Conn. See page 40

Casey-Hedges Co., Chattanooga, Tenn. See pages 42, 43

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. See page 190

*Erie City Iron Works, Erie, Pa. See page 12

Farquhar Co., Ltd., A. B., York, Pa.

Frost Mfg. Co., Galesburg, Ill.

Gem City Boiler Co., Dayton, O.

Godfrey-Keeler Co., 70 Warren St., New York, N. Y.

Houston, Stanwood & Gamble Co., Cincinnati, O. See pages 46, 47

International Boiler Works Co., East Stroudsburg, Pa.

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. See page 191

Lookout Boiler & Mfg. Co., Chattanooga, Tenn.

Manitowoc Shipbuilding Co., Manitowoc, Wis.

Murray Iron Works Co., Burlington, Ia. See page 16

Orr & Sombower, Inc., Reading, Pa.

Rue Mfg. Co., 228 Cherry St., Philadelphia, Pa.

Smith & Son Co., Sam'l, Paterson, N. J.

Wood, Wm. H., Media, Pa.

Marine

*Almy Water Tube Boiler Co., Providence, R. I. See page 33

Atlantic Works, 80 Border St., East Boston, Mass.

*Babcock & Wilcox Co., 85 Liberty St., New York, N. Y. See pages 34, 35, 36, 37

Bath Iron Works, Ltd., Bath, Me.

Casey-Hedges Co., Chattanooga, Tenn. See pages 42, 43

Advertisements of firms marked * appear in *The Journal*, A. S. M. E.

Fitzgibbons Boiler Co., E. 10th & Mercer
Sts., Oswego, N. Y.
Gas Engine & Power Co., and Charles L.
Seabury & Co., Consolidated, Morris
Heights, New York, N. Y.
International Boiler Works Co., East Strouds-
burg, Pa.

*Keeler Co., E., Williamsport, Pa. *See page 45*
Kingsford Foundry & Machine Works, Os-
wego, N. Y.

LaCrosse Boiler Co., LaCrosse, Wis.
Lee Co., Wm. O., Port Huron, Mich.
Manitowoc Boiler Works, Manitowoc, Wis.
Manitowoc Shipbuilding Co., Manitowoc,
Wis.

Murray Iron Works Co., Burlington, Ia. *See*
page 16

Pennsylvania Boiler Works, Erie, Pa.

*Power Specialty Co., 111 Broadway, New
York, N. Y.

Rees & Sons Co., James, Pittsburgh, Pa.
Reliance Boiler Works, Oshkosh, Wis.
Roberts Safety Water Tube Boiler Co., 39
Cortlandt St., New York, N. Y.

Talbot Boiler Co., 120-122 Liberty St., New
York, N. Y.

Valk & Murdoch Co., Charleston, S. C.
Ward Engineering Works, Charles, Charleston,
W. Va. *See page 56*

Oil Burning

Talbot Boiler Co., 120-122 Liberty St., New
York, N. Y.

Portable

Casey-Hedges Co., Chattanooga, Tenn. *See*
pages 42, 43

Gem City Boiler Co., Dayton, O.
Houston, Stanwood & Gamble Co., Cincinnati,
O. *See pages 46, 47*

Nagle Engine & Boiler Works, Erie, Pa.
Oil Well Supply Co., 213-215 Water St.,
Pittsburgh, Pa.

*Power Specialty Co., 111 Broadway, New York,
N. Y.

Talbot Boiler Co., 120-122 Liberty St., New
York, N. Y.

Return Tubular

Ames Iron Works, Oswego, N. Y.
Baker Iron Works, 950 N. Broadway, Los
Angeles, Cal.

Bass Foundry & Machine Co., Fort Wayne,
Ind. *See page 39*

*Bigelow Co., 76 River St., New Haven, Conn.
See page 40

Brownell Co., Dayton, O.

Casey-Hedges Co., Chattanooga, Tenn. *See*
pages 42, 43

Chandler & Taylor Co., Indianapolis, Ind.
Clark Engine & Boiler Co., Kalamazoo,
Mich.

Coatesville Boiler Works, Coatesville, Pa.

Cole Mfg. Co., R. D., Newnan, Ga.

*Connolly Boiler Co., D., Cleveland, O.

Dillon Steam Boiler Works, D. M., Fitchburg,
Mass.

Dover Boiler Works, 50 Church St., New York,
N. Y.

Dutton Co., C. H., Kalamazoo, Mich.

*Erie City Iron Works, Erie, Pa. *See page 12*

Farquhar Co., Ltd., A. B., York, Pa.

Freeman & Sons Mfg. Co., S., Racine, Wis.

Frost Mfg. Co., Galesburg, Ill.

Gem City Boiler Co., Dayton, O.

Godfrey-Keeler Co., 70 Warren St., New York,
N. Y.

Griffith & Wedge Co., Zanesville, O.

Houston, Stanwood & Gamble Co., Cincinnati,
O. *See pages 46, 47*

International Engineering Works, Ltd., Fram-
ingham, Mass.

*Keeler Co., E., Williamsport, Pa. *See page 45*

LaCrosse Boiler Co., LaCrosse, Wis.

Lee Co., Wm. O., Port Huron, Mich.

Lookout Boiler & Mfg. Co., Chattanooga,
Tenn.

Lucey Mfg Corp'n of Texas, 308 Texas Co.
Bldg., Houston, Tex.

McDermott Engineering Co., Whitehall &
Jordan Sts., Allentown, Pa.

McEwen Bros., Wellsville, N. Y.

MacKinnon Boiler & Machine Co., 218-230
N. Water St., Bay City, Mich.

McLaughlin Mfg. Co., Geo. G., 24 Washington
St., North, Boston, Mass.

Milwaukee Boiler Co., 220 Oregon St., Mil-
waukee, Wis. *See page 50*

Murphy Iron Works, John H., 643 Magazine
St., New Orleans, La.

Murray Iron Works Co., Burlington, Ia. *See*
page 16

Muskegon Boiler Works, Muskegon, Mich.

Nagle Engine & Boiler Works, Erie, Pa.

O'Brien Boiler Works Co., John, 1801 N. 11th
St., St. Louis, Mo.

Pennsylvania Boiler Works, Erie, Pa.

Reliance Boiler Works, Oshkosh, Wis.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau
Ave., St. Louis, Mo.

Schofield's Sons Co., J. S., Macon, Ga.

Smith & Son Co., Sam'l, Paterson, N. J.

*Springfield Boiler & Mfg. Co., Springfield, Ill.
See page 54

Stewart Boiler Works, Worcester, Mass.

Uniflow Boiler Co., Inc., 2 S. 15th St., Phila-
delphia, Pa.

Vogt Machine Co., Henry, Louisville, Ky.
See page 55

*Wickes Boiler Co., Saginaw, Mich. *See page*
57

Wilson Machine Co., W. A., 217 N. Water
St., Rochester, N. Y.

Vertical Tubular

*Bigelow Co., 76 River St., New Haven, Conn.
See page 40

Casey-Hedges Co., Chattanooga, Tenn. *See*
pages 42, 43

Clark Engine & Boiler Co., Kalamazoo, Mich.

*Clyde Iron Works, 29th Ave. West & Michigan
St., Duluth, Minn. *See page 190*

Cole Mfg. Co., R. D., Newnan, Ga.

Dillon Steam Boiler Works, D. M., Fitchburg,
Mass.

Dutton Co., C. H., Kalamazoo, Mich.

Frost Mfg. Co., Galesburg, Ill.

Gem City Boiler Co., Dayton, O.

Godfrey-Keeler Co., 70 Warren St., New York,
N. Y.

International Boiler Works, Co., East Strouds-
burg, Pa.

International Engineering Works, Ltd., Fram-
ingham, Mass.

*Lidgerwood Mfg. Co., 96 Liberty St., New
York, N. Y. *See page 191*

Nagle Engine & Boiler Works, Erie, Pa.

*Power Specialty Co., 111 Broadway, New York,
N. Y.

Smith & Son Co., Sam'l, Paterson, N. J.

Stewart Boiler Works, Worcester, Mass.

Walsh & Weidner Boiler Co., Chattanooga,
Tenn.

Water Tube

Abendroth & Root Mfg. Co., 45 Broadway,
New York, N. Y.

*Almy Water Tube Boiler Co., Providence, R. I.
See page 33

*Babcock & Wilcox Co., 85 Liberty St., New
York, N. Y. *See pages 34, 35, 36, 37*

Bass Foundry & Machine Co., Fort Wayne,
Ind. *See page 39*

*Bigelow Co., 76 River St., New Haven, Conn.
See page 40

Brennan & Co., John, Detroit, Mich.

*Connolly Boiler Co., D., Cleveland, O.

*Edge Moor Iron Co., Edge Moor, Del. *See*
page 41

*Erie City Iron Works, Erie, Pa. *See page 12*

Flanner Water-Tube Boiler Co., Akron, O.
See page 44

Boi

See Catalogue Section for data of firms listed in bold face type

BOILERS (continued)**Water Tube**

- Freeman & Sons Mfg. Co., S. Racine, Wis.
 Granger Co., A. D., 90 West St., New York, N. Y.
 Harris Municipal Garbage Incinerator & Steam Generator Co., 65 Life & Casualty Bldg., Nashville, Tenn.
 *Heine Safety Boiler Co., St. Louis, Mo.
 Hobson, Russell B., 455 Kessel Ave., New Brighton, N. Y.
 *Keeler Co., E., Williamsport, Pa. *See page 45*
 Kingsford Foundry & Machine Works, Oswego, N. Y.
 Ladd Co., George T., 1620 Farmers Bank Bldg., Pittsburgh, Pa. *See pages 48, 49*
 McNaull Boiler Mfg. Co., Toledo, O.
 Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*
 Morrison Boiler Co., Sharon, Pa.
 Murray Iron Works Co., Burlington, Ia. *See page 16*
 Nagle Engine & Boiler Works, Erie, Pa.
 O'Brien Boiler Works Co., John, 1601 N. 11th St., St. Louis, Mo.
 Oil City Boiler Works, Oil City, Pa.
 Page Boiler Co., 815-819 Larrabee St., Chicago, Ill. *See page 52*
 *Springfield Boiler & Mfg. Co., Springfield, Ill. *See page 54*
 Stirling, Allan, 878 Drexel Bldg., Philadelphia, Pa.
 Talbot Boiler Co., 120-122 Liberty St., New York, N. Y.
 Vogt Machine Co., Henry, Louisville, Ky. *See page 53*
 Walsh & Weidner Boiler Co., Chattanooga, Tenn.
 Ward Engineering Works, Charles, Charleston, W. Va. *See page 56*
 *Wickes Boiler Co., Saginaw, Mich. *See page 57*
 Winslow Safety High Pressure Boiler Co., 4600 W. Harrison St., Chicago, Ill.

Boi BOILERS RETUBED

- Wendland Engrg. & Const. Co., C. F., 63 Wooster St., New York, N. Y.

BOLT CUTTERS, HEADERS, ETC.
(See Cutters, Headers, etc., Bolt)**BOLT AND NUT MACHINERY**

- Ajax Mfg. Co., Cleveland, O.
 Brown Co., H. B., East Hampton, Conn.
 Howard Iron Works, 285 Chicago St., Buffalo, N. Y.
 Pawtucket Mfg. Co., Pawtucket, R. I.
 Webster & Perks Tool Co., Springfield, O.

BOLTS

- American Iron & Steel Mfg. Co., Lebanon, Pa.
 American Screw Co., Providence, R. I. *See pages 256, 257*
 Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.
 Falls Rivet Co., Kent, O.
 Ohio Nut & Bolt Co., Berea, O.
 Pawtucket Mfg. Co., Pawtucket, R. I.
 Phillips Mfg. Co., R. B., 3 Grand St. Ct., Worcester, Mass.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*
 Upson Nut Co., Cleveland, O.

Expansion

- Brohard Co., 3rd St. & Lehigh Ave., Philadelphia, Pa.
 Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*
 National Lead Co., 111 Broadway, New York, N. Y. *See pages 260, 261*
 Star Expansion Bolt Co., 147-149 Cedar St., New York, N. Y.
 Steward & Romaine Mfg. Co., 124 N. 6th St., Philadelphia, Pa.

Brass and Bronze

- St. Louis Screw Co., St. Louis, Mo.
 Steward & Romaine Mfg. Co., 124 N. 6th St., Philadelphia, Pa.

Eye

- Page-Storms Drop Forge Co., Chicopee, Mass.

Frog

- Bethlehem Steel Co., South Bethlehem, Pa.

Machine

- Hall's Sons, Samuel, 229 W. 10th St., New York, N. Y.
 Rhode Island Tool Co., Providence, R. I.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*
 St. Louis Screw Co., St. Louis, Mo.

Patch

- St. Louis Screw Co., St. Louis, Mo.

Spring

- Bowen Mfg. Co., Auburn, N. Y.
 Ferry Cap & Set Screw Co., 2151 Scranton Road, Cleveland, O.
 Fostoria Screw Co., Fostoria, O.
 Michigan Screw Co., Lansing, Mich.

Stove

- American Screw Co., Providence, R. I. *See pages 256, 257*

- Reading Screw Co., Norristown, Pa.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*

Stud

- Ferry Cap & Set Screw Co., 2151 Scranton Road, Cleveland, O.
 Hall's Sons, Samuel, 229 W. 10th St., New York, N. Y.
 Niagara Screw Co., 20 Lock St., Buffalo, N. Y.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*
 St. Louis Screw Co., St. Louis, Mo.

Tap

- Hall's Sons, Samuel, 229 W. 10th St., New York, N. Y.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*

Tire

- American Screw Co., Providence, R. I. *See pages 256, 257*
 Reading Screw Co., Norristown, Pa.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*

Toggle

- Brohard Co., 3rd St. & Lehigh Ave., Philadelphia, Pa.
 Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*
 Star Expansion Bolt Co., 147-149 Cedar St., New York, N. Y.
 Steward & Romaine Mfg. Co., 124 N. 6th St., Philadelphia, Pa.

Track

- Bethlehem Steel Co., South Bethlehem, Pa.
 National Bolt & Nut Co., 2nd St. & A. V. R. R., Pittsburgh, Pa.
 Upson Nut Co., Cleveland, O.

BOLTING CLOTH

- Abbé Engineering Co., 220 Broadway, New York, N. Y.

BOOK-BINDERS' MACHINERY

- Sigourney Tool Co., 9 Sigourney St., Hartford, Conn.

BOOSTERS, GAS

- *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

BORING HEADS, OFFSET

- Marvin & Casler Co., Canastota, N. Y.

BORING MACHINES

- Beaman & Smith Co., Providence, R. I.

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

Cylinder

Barrett Machine Tool Co., Meadville, Pa.
Hartford Engine Works, 223 State St., Hartford, Conn.
Moline Tool Co., 319—20th St., Moline, Ill.
Pedrick Tool & Machine Co., Lawrence St. & Erie Ave., Philadelphia, Pa.
Ready Tool Co., Bridgeport, Conn.
Rooksby & Co., E. J., 435 W. 11th St., Philadelphia, Pa.

Locomotive Cylinder

Barrett Machine Tool Co., Meadville, Pa.
Rooksby & Co., E. J., 435 W. 11th St., Philadelphia, Pa.

Valve Chamber

Rooksby & Co., E. J., 435 W. 11th St., Philadelphia, Pa.

Multiple Spindle

National Automatic Tool Co., Richmond, Ind.

Vertical

Baker Bros., Toledo, O.

BORING TOOLS

(See Tools, Boring)

BORING AND DRILLING MACHINES,

HORIZONTAL

Cleveland Machine Tool Works, 3213-3225 Superior Ave., Cleveland, O.
Fosdick Machine Tool Co., Blue Rock & Apple St., Cincinnati, O.
Lucas Machine Tool Co., E. 99th St. & N. Y. C. R. R., Cleveland, O.
Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.
Pawling & Harnischfeger Co., Milwaukee, Wis.

BORING AND TURNING MILLS, VERTICAL

Betts Machine Co., Wilmington, Del.
Bickford & Co., H., Lakeport, N. H.
Cincinnati Planer Co., Oakley, Cincinnati, O.

See page 228

Colburn Machine Tool Co., Franklin, Pa.
Gisholt Machine Co., Madison, Wis.
*King Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

BORING, DRILLING AND MILLING MACHINES (Horizontal Combined)

Cleveland Machine Tool Works, 3213-3225 Superior Ave., Cleveland, O.
Detrick & Harvey Machine Co., Baltimore, Md.
Universal Boring Machine Co., 30 Tower St., Hudson, Mass.

BOTTLE-BLOWING MACHINERY

Dice Machine Co., Anderson, Ind.

BOTTLE WASHING MACHINERY

Rice & Adams Corp'n, Buffalo, N. Y.

BOTTLING MACHINERY

Loew Mfg. Co., 9001 Madison Ave., N. W., Cleveland, O.

BOX MACHINERY

Paper

Griswold Machine Co., George M., Cor. Bradley & William Sts., New Haven, Conn.

Wooden

Chase Turbine Mfg. Co., Orange, Mass.
Meren-Johnson Machine Co., Minneapolis, Minn.

BOXES

Annealing and Carbonizing

Garwood Bronze & Iron Works, Garwood, N. J.

Fibre

*American Vulcanized Fibre Co., Wilmington, Del. *See page 203*

Fuse

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Metal

Cleveland Wire Spring Co., Cleveland, O.
Lyon Metallic Mfg. Co., Aurora, Ill.

Metal (Tool)

Globe Machine & Stamping Co., Cleveland, O.

Ticket Cancelling

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

BRACES, BOILER

Glasgow Iron Co., Pottstown, Pa. *See page 60*

Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*

Scully Steel & Iron Co., Chicago, Ill.

BRACKETS, INSULATOR

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*

BRAIDING MACHINES

New England Butt Co., Providence, R. I. *See page 304*

Textile Machine Works, Reading, Pa. *See page 305*

BRAIDING WHEELS

Peninsular Emery Wheel Co., 253 Meldrum Ave., Detroit, Mich.

BRAKES

Air

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Electric

Electric Controller & Mfg. Co., Cleveland, O.

BRAKE BLOCKS

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

BRASS AND COPPER (Roll, Sheet)

American Brass Co., Waterbury, Conn. *See page 204* **Br**

Bridgeport Brass Co., Bridgeport, Conn.
Chase Rolling Mill Co., Waterbury, Conn.
Scoville Mfg. Co., Waterbury, Conn.

BRASS GOODS

American Brass Co., Waterbury, Conn. *See page 204*

American Lubricator Co., Detroit, Mich.

Bartlett Hayward Co., Baltimore, Md.

Mueller Mfg. Co., H., Decatur, Ill.

Scoville Mfg. Co., Waterbury, Conn.

BRASS MILL MACHINERY

Torrington Mfg. Co., Torrington, Conn. *See page 240*

BRASS WORK (Ornamental)

(See Ornamental Work)

BRASS-WORKING MACHINE TOOLS

(See Tools, Brass-Working Machine)

BRATTICE CLOTH

Kern Commercial Co., 114 Liberty St., New York, N. Y.

BRAZING

American Tube Bending Co., New Haven, Conn.

BREECHINGS, SMOKE

Casey-Hedges Co., Chattanooga, Tenn. *See pages 42, 43*

Pickham Boiler Co., 3035 W. Jackson Blvd., Chicago, Ill.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.

Turl Iron & Car Co., Inc., 50 Broad St., New York, N. Y.

BREWERS AND BOTTLERS MACHINERY

*Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*

See Catalogue Section for data of firms listed in bold face type

BRICK**Acid Proof**

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

Arch (Locomotive)

American Arch Co., McCormick Bldg., Chicago, Ill.

Blast Furnace

Ashland Fire Brick Co., Ashland, Ky.

Carborundum

Didier-March Co., P. O. Box 327, Perth Amboy, N. J.

Chrome

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

Enameled

American Enameled Brick & Tile Co., 52 Vanderbilt Ave., New York, N. Y.

Fire

Ashland Fire Brick Co., Ashland, Ky.
Betsen Plastic Fire Brick Co., Rome, N. Y.
Didier-March Co., P. O. Box 327, Perth Amboy, N. J.

Evans & Howard Fire Brick Co., 920 Market St., St. Louis, Mo.

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

Maurer & Son, Henry, 420 E. 23rd St., New York, N. Y.

McLeod & Henry Co., Troy, N. Y.

Pliable Fire Brick Co., 133 W. Washington St., Chicago, Ill.

Pyro Clay Products Co., Oak Hill, O.
Taylor Sons Co., Chas., Cincinnati, O.

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Insulating

Armstrong Cork & Insulation Co., 122 24th St., Pittsburgh, Pa. *See page 120*

Didier-March Co., P. O. Box 327, Perth Amboy, N. J.

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Magnesia

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

Rubbing

Carborundum Co., Niagara Falls, N. Y. *See page 248*

Norton Co., Worcester, Mass. *See page 249*

Silica

Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.

BRICK MACHINERY

Arnold-Creager Co., New London, O.

Bonnot Co., Canton, O.

Chambers Bros. Co., 52nd & Media Sts., Philadelphia, Pa.

Naylor Bros., Peekskill, N. Y.

Schultz & Son, A. L., 1675 Elston Ave., Chicago, Ill.

BRIDGE TRAMWAYS

(See Tramways, Bridge)

BRIDGES**Movable**

American Bridge Co., 30 Church St., New York, N. Y.

Steel

Canton Bridge Co., Canton, O.

McClintic-Marshall Co., 1217 Oliver Bldg., Pittsburgh, Pa.

Stocking and Reclaiming

(See Tramways, Bridge)

Suspension

*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*

BRIDLE RINGS

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*

BROACHING MACHINES

Lapointe Machine Tool Co., Hudson, Mass.

BRONZES

Allan & Son, A., 484 Greenwich St., New York, N. Y. *See page 200*

American Bronze Co., Berwyn, Pa. *See pages 198, 199*

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Phosphor

Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Plastic

Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

Manganese

Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

BRONZE WORK (Ornamental)

(See Ornamental Work)

BUCKETS**Elevator**

Birmingham Boiler Works, Birmingham, Ala.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*

Cross Engineering Co., Carbondale, Pa.

Hendrick Mfg. Co., Dundaff St., Carbondale, Pa.

Link-Belt Co., Chicago, Ill. *See page 178*

Moore & Lorenz Co., 2144-52 W. Fulton St., Chicago, Ill.

Skillin & Richards Mfg. Co., 4520 Cortland St., Chicago, Ill.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Excavating

Andresen-Evans Co., 646 Railway Exchange Bldg., Chicago, Ill.

Hayward Co., 50 Church St., New York, N. Y.

Williams Co., G. H., Erie, Pa.

Grab

Andresen-Evans Co., 646 Railway Exchange Bldg., Chicago, Ill.

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*

Haiss Mfg. Co., Geo., 141st St. & Rider Ave., New York, N. Y.

Hayward Co., 50 Church St., New York, N. Y.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

Industrial Works, Bay City, Mich. *See page 189*

Link-Belt Co., Chicago, Ill. *See page 178*

Mead Morrison Mfg. Co., East Boston, Mass.

*Orton & Steinbrenner Co., 608 So. Dearborn St., Chicago, Ill.

Williams Co., G. H., Erie, Pa.

Hoisting

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Orange Peel

Andresen-Evans Co., 646 Railway Exchange Bldg., Chicago, Ill.

Hayward Co., 50 Church St., New York, N. Y.

Bri

Self-Dumping

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
 *Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
 Insley Mfg. Co., Indianapolis, Ind.
 Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

BUFFER, RADIAL (Locomotive)

Economy Devices Corp'n, 30 Church St., New York, N. Y.

BUILDING MATERIALS (Sheet Metal)

Edwards Mfg. Co., 306-336 Eggleston Ave., Cincinnati, O. *See page 269*

BULLDOZERS

Ajax Mfg. Co., Cleveland, O.
 Long & Allstatter Co., Hamilton, O. *See page 213*
 Rock River Machine Co., Janesville, Wis.
 Williams, White & Co., Moline, Ill. *See page 215*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

BULL RING METAL

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*
 Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

BUNDLERS, SCRAP METAL

Logemann Brothers Co., Milwaukee, Wis.

BURNERS**Gas**

Creaghead Engineering Co., 340-342 Main St., Cincinnati, O.
 Eclipse Fuel Engineering Co., Rockford, Ill.
 Gwynn Gas Burner & Engrg. Co., 713-714 Empire Bldg., Pittsburgh, Pa. *See page 70*
 Johnson Co., S. T., 1337 Mission St., San Francisco, Cal.
 Oven Equipment & Mfg. Co., New Haven, Conn.
 Sauer Power Generating Co., 5115-19 Rosetta St., Pittsburgh, Pa.
 Selas Co., 521 W. 23rd St., New York, N. Y. *See page 267*
 Syracuse Industrial Gas Co., 206 McCarthy Bldg., Syracuse, N. Y.

Oil

Anthony Co., 138 West Ave., Long Island City, N. Y. *See page 264*

*Best, Inc., W. N., 11 Broadway, New York, N. Y. *See page 265*

Gearhart Oil Burner Co., 1314 Eye St., Fresno, Cal.

*Gilbert & Barker Mfg. Co., Springfield, Mass. *See page 266*

Hammel Oil Burning Equipment Co., 350 Pearl St., New York, N. Y.

Hauck Mfg. Co., 140 Livingston St., Brooklyn, N. Y.

Johnson Co., S. T., 1337 Mission St., San Francisco, Cal.

Metals Production Equipment Co., 105 W. 40th St., New York, N. Y.

Modern Engineering Co., 14th & St. Charles Sts., St. Louis, Mo.

National Supply Co., 416 W. Grand Ave., Chicago, Ill.

Reid Gas Engine Co., Joseph, Oil City, Pa.

*Spray Engineering Co., 93 Federal St., Boston, Mass. *See page 87*

Tate, Jones & Co., Inc., Pittsburgh, Pa.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Oil (Rotary)

Johnson Co., S. T., 1337 Mission St., San Francisco, Cal.

Powdered Coal

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

BUSHINGS**Bronze**

American Bronze Co., Berwyn, Pa. *See pages 198, 199*

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

Loose-Pulley

Arguto Oilless Bearing Co., Wayne Junction, Philadelphia, Pa.

Metaline Co., West Ave. near Borden, Long Island City, N. Y.

BYPRODUCT RECOVERY PLANTS

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

C**CABINETS, METAL**

Terrell's Equipment Co., Grand Rapids, Mich.

CABLE, WIRE

(See Rope, Wire)

CABLES, ELECTRICAL

(See Wire and Cables, Electrical)

CABLE RAILWAYS

(See Railways, Cable)

CABLE TESTING APPARATUS

Thompson-Levering Co., 323 Arch St., Philadelphia, Pa.

CABLEWAYS**Excavating**

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Hoisting and Conveying

Flory Mfg. Co., S. Bangor, Pa.

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

CABLING MACHINES

New England Butt Co., Providence, R. I. *See page 304*

Torrington Mfg. Co., Torrington, Conn. *See page 240*

CAGES**Elevator**

Smith-Rhea Co., Baltimore, Md.

Mine

Holmes & Bros., Rob't, Danville, Ill.

Ottumwa Iron Works, Ottumwa, Ia.

Mine (Self Dumping)

Holmes & Bros., Rob't, Danville, Ill.

CALORIMETERS

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*

American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*

Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

Ellison, Lewis M., 214 W. Kinzie St., Chicago, Ill.

Emerson Apparatus Co., 251 Causeway St., Boston, Mass.

*Precision Instrument Co., Detroit, Mich. *See page 320*

Sargent Steam Meter Co., 1902 N. California Ave., Chicago, Ill.

Schaeffer & Eudenberg Mfg. Co., Brooklyn, N. Y. *See page 329*

*Smith Gas Engineering Co., Lexington, O.

Standard Calorimeter Co., East Moline, Ill.

CAN MAKING MACHINERY

American Compressor & Pump Co., 801-5 E. Pratt St., Baltimore, Md.

Ams Machine Co., Max, Bridgeport, Conn.

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Leffler & Co., Chas., 49-73 Clymer St., Brooklyn, N. Y.

See Catalogue Section for data of firms listed in bold face type

CAN MAKING MACHINERY (continued)

Seattle-Astoria Iron Works, 601 Myrtle St., Seattle, Wash.

CANNING MACHINERY, SALMON

Seattle-Astoria Iron Works, 601 Myrtle St., Seattle, Wash.

CANS, OIL

Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.

CAPSTANS

Flory Mfg. Co., S., Bangor, Pa.
Ohio Injector Co., S. Main St., Wadsworth, O.
Red Wing Iron Works, Red Wing, Minn.

Electric

Maine Electric Co., 35 Commercial St., Portland, Me.

CARBIDE (Cake Form)

Carbic Mfg. Co., West Duluth, Minn.

CARBONIC ACID GAS MACHINERY

Carbondale Machine Co., Carbondale, Pa.
See page 307

CARBORUNDUM

(See Abrasive Materials)

CARBURETORS

American Watch Tool Co., Waltham, Mass.
Meriam Co., 1514 Prospect Ave., S. E., Cleveland, O.

CARRIERS

Cash and Parcel

Baldwin & Co., James L., 358 W. Madison St., Chicago, Ill.
Lamson Co., 100 Boylston St., Boston, Mass.
See pages 184, 185
Universal Tube Co., 142-152 W. Ohio St., Chicago, Ill.

Pick-up and Delivery

Lamson Co., 100 Boylston St., Boston, Mass.
See pages 184, 185

Pneumatic

(See Tubes, Pneumatic)

CARRIERS AND ELEVATORS, FREIGHT

Brown Portable Elevator Co., Chicago, Ill.
See page 179

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*

*Link-Belt Co., Chicago, Ill. *See page 178*
Minnesota Manufacturers' Assoc., North St. Paul, Minn.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

CAR DUMPERS

McMyler Interstate Co., Bedford, O.

CAR LIFTS, MINE (Automatic)

Holmes & Bros., Rob't, Danville, Ill.

CAR PULLERS (Electric)

Maine Electric Co., 35 Commercial St., Portland, Me.

CARS

Ballast

Ballast Car Co., Rodger, 523 Railway Exchange, Chicago, Ill.

Bottom Dump

Stuebner Iron Works, O. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Charging

Sackett Screen & Chute Co., H. B., 1679-1693 Elston Ave., Chicago, Ill.

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Cinder

*Weimer Machine Works Co., Lebanon, Pa.

Concreting (Gasoline)

McKeen Motor Car Co., Omaha, Nebr

Dump

Ballast Car Co., Rodger, 523 Railway Exchange, Chicago, Ill.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

Insley Mfg. Co., Indianapolis, Ind.

National Dump Car Co., 519 Railway Exchange Bldg., Chicago, Ill.

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Freight (Drop Bottom)

National Dump Car Co., 519 Railway Exchange Bldg., Chicago, Ill.

Industrial Railway

Atlas Car & Mfg. Co., Cleveland, O.

Bergen Point Iron Works, West 5th St., Bayonne, N. J.

Chase Foundry & Mfg. Co., Columbus, O.

Chattanooga Car & Foundry Co., Chattanooga, Tenn.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

*Link-Belt Co., Chicago, Ill. *See page 178*

Orenstein-Arthur Koppel Co., Canton, O.

Sackett-Screen & Chute Co., H. B., 1679-1693 Elston Ave., Chicago, Ill.

Stuart Foundry & Machine Work, R. J. & F. H., New Hamburg, N. Y.

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Turl Iron & Car Co., Inc., 50 Broad St., New York, N. Y.

Watt Mining Car Wheel Co., Barnesville, O.

Youngstown Steel Car Co., 1609 Wilson Ave., Youngstown, O.

Ingot

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Mine

Day Iron Works, Sanford, Knoxville, Tenn.

Hockensmith Wheel & Mine Car Co., Penns Station, Pa.

Ottumwa Iron Works, Ottumwa, Pa.

Star Mfg. Co., New Lexington, O.

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Youngstown Steel Car Co., 1609 Wilson Ave., Youngstown, O.

Platform

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Railroad

Chattanooga Car & Foundry Co., Chattanooga, Tenn.

Midvale Steel Co., Widener Bldg., Philadelphia, Pa.

Osgood Bradley Car Co., Worcester, Mass.

Pressed Steel Car Co., Farmers Bank Bldg., Pittsburgh, Pa.

Wason Mfg. Co., Springfield, Mass.

Youngstown Steel Car Co., 1609 Wilson Ave., Youngstown, O.

Railroad Inspection

Tector-Hartley Motor Co., Hagerstown, Ind.

Railroad Motor

Hall-Scott Motor Car Co., Inc., Crocker Bldg., San Francisco, Cal.

McKeen Motor Car Co., Omaha, Nebr.

Sheffield Car Co., Three Rivers, Mich.

Soaking Pit

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Can

Trolley (Industrial Railway)

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

CARTON SEALING MACHINES

(See Sealing Machines, Carton)

CASE HARDENING

American Metal Treatment Co., Elizabeth, N. J.

Connecticut Metal Treating, 207 Knowlton St., Bridgeport, Conn.

CASH AND PARCEL CARRIERS

(See Carriers, Cash and Parcel)

CASING, STEAM PIPE

Wyckoff & Son Co., A., Elmira, N. Y. *See pages 122, 291*

CASINGS, STEEL (Boiler)

Casey-Hedges Co., Chattanooga, Tenn. *See pages 42, 43*

Houston, Stanwood & Gamble Co., Cincinnati, O. *See pages 46, 47*

CASTERS, TRUCK

Clark Co., George P., Windsor Locks, Conn.

Foster, Merriam & Co., Meriden, Conn.

CASTING MACHINES, PIG IRON

Pittsburgh Coal Washer Co., 812 Fulton Bldg., Pittsburgh, Pa.

CASTINGS**Acid-Resistant**

Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.

Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

Aluminum

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Franklin Mfg. Co., H. H., 730 Gifford St., Syracuse, N. Y.

Germann Bronze Co., Erie, Pa.

Van Wagner Mfg. Co., E. B., Syracuse, N. Y.

Brass and Bronze

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

American Bronze Co., Berwyn, Pa. *See pages 198, 199*

American Injector Co., Detroit, Mich. *See page 116*

Atlas Brass Foundry Co., 980 S. Front St., Columbus, O.

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Chrisman-Goodwin Foundry Co., Morgantown, W. Va.

Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. *See page 92*

D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 108*

Eastwood Wire Mfg. Co., Belleville, N. J.

Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

Foster, Merriam & Co., Meriden, Conn.

Germann Bronze Co., Erie, Pa.

Harris & Co., Arthur, 212 Curtis St., Chicago, Ill.

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Leslie Co., Lyndhurst, N. J. *See page 111*

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

McCord Mfg. Co., Detroit, Mich. *See page 127*

Miller Lock Co., Philadelphia, Pa.

Nolte Brass Co., Springfield, O.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Sandusky Foundry & Machine Co., Sandusky, O.

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Copper

Snead & Co. Iron Works, Foot of Pine St., Jersey City, N. J.

Die-Molded

American Brass Co., Waterbury, Conn. *See page 204*

*Doehler Die-Casting Co., Brooklyn, N. Y. *See page 263*

Franklin Mfg. Co., H. H., 730 Gifford St., Syracuse, N. Y.

Indiana Die Casting Co., 1016 E. 11th St., Indianapolis, Ind.

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Moberg, Inc., C. J., Mt. Vernon, N. Y.

Muzzy-Lyon Co., Ltd., Detroit, Mich.

Parker White Metal & Machine Co., 23rd & R. R. Sts., Erie, Pa.

Stewart Mfg. Co., Wells St., Bridge, Chicago, Ill.

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Van Wagner Mfg. Co., E. B., Syracuse, N. Y.

Vesder Mfg. Co., Hartford, Conn. *See page 341*

Iron

Ajax Iron Works, Corry, Pa.

Bass Foundry & Machine Co., Fort Wayne, Ind. *See page 39*

Bay City Foundry & Machine Co., Bay City, Mich.

Bellefonte Engineering Co., Bellefonte, Pa.

Braddock Machine & Mfg. Co., Braddock, Pa.

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*

Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.

Burham Co., Edwin, 71 Wall St., New York, N. Y.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

Casey-Hedges Co., Chattanooga, Tenn. *See pages 42, 43*

*Central Foundry Co., 90 West St., New York, N. Y. *See page 105*

Chattanooga Car & Foundry Co., Chattanooga, Tenn.

Chester Steel Castings Co., Chester, Pa.

Chrisman-Goodwin Foundry Co., Morgantown, W. Va.

Columbus Iron Works Co., Columbus, O.

Cox & Sons Co., Bridgeton, N. J.

Cutter, Geo. A., Taunton, Mass.

Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. *See page 92*

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

*Falls Clutch & Machinery Co., Cuyahoga Falls, O. *See page 143*

Falls Machine Co., Sheboygan Falls, Wis.

Farrar & Trefits, 54-66 Perry St., Buffalo, N. Y.

Ferro Machine & Foundry Co., Cleveland, O.

Poster, Merriam & Co., Meriden, Conn.

Gardner General Foundry Co., Gardner, Mass.

Great Lakes Engineering Works, Detroit, Mich.

Griffith & Wedge Co., Zanesville, O.

Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*

Hefner & Maysilles, Grafton, W. Va.

Hewes & Philip Iron Works, Newark, N. J.

*Hill Clutch Co., Cleveland, O. *See page 148*

*Hooven, Owens, Rentschler Co., Hamilton, O.

O'Isam Flush Tank Co., 4609-14th Ave., N. W., Seattle, Wash.

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Kline Hardware Co., Allentown, Pa.

Klotz Machine Co., 318 W. Water St., Sandusky, O.

Kutztown Foundry & Machine Co., Inc., Kutztown, Pa.

Lake Erie Engineering Works, Buffalo, N. Y.

Lane & Bodley, Bond Hill, Cincinnati, O.

Cas

See Catalogue Section for data of firms listed in bold face type

CASTINGS (continued)

Iron

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 69*
MacKinnon Boiler & Machine Co., 218-230 N. Water St., Bay City, Mich.
Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
Maryland Iron & Steel Co., 15 Wall St., New York, N. Y.
McNaughton Mfg. Co., Maryville, Tenn.
Michigan Press Co., Ypsilanti, Mich.
Munson, E. G., Carton Ave., Utica, N. Y.
Murray Iron Works & Co., Burlington, Ia. *See page 16*
Myerstown Foundry & Mfg. Co., Inc., 90 West St., New York, N. Y.
Naylor Bros., Peekskill, N. Y.
Neemes Bros., 206-216 First St., Troy, N. Y.
Nelsonville Foundry & Machine Co., Nelsonville, O.
Park Mfg. Co., Charlotte, N. C.
Perkins Co., Henry, Bridgewater, Mass.
Philadelphia Roll & Machine Co., 25th & Washington Ave., Philadelphia, Pa.
Phoenix Iron Works Co., Meadville, Pa. *See page 53*
***Pittsburgh Valve, Foundry & Construction Co.**, Pittsburgh, Pa. *See pages 102, 103*
Poole Engineering & Machine Co., Baltimore, Md.
Portsmouth Engine Co., Portsmouth, O.
Sackett, A. J., Baltimore, Md.
Snead & Co. Iron Works, Foot of Pine St., Jersey City, N. J.
Sowers Mfg. Co., 1298-1310 Niagara St., Buffalo, N. Y.
Standard Engineering Co., Ellwood City, Pa.
Steady-Schmidt Mfg. Co., York, Pa.
Sterritt-Thomas Foundry Co., 32nd & Smallman Sts., Pittsburgh, Pa.
Stowell Co., So. Milwaukee, Wis.
Stuart Foundry & Machine Works, R. J. & F. H., New Hamburg, N. Y.
Sullivan, John N., Hickory & Mattes Sts., Scranton, Pa.
Tamaqua Mfg. Co., Tamaqua, Pa.
Textile Machine Works, Reading, Pa. *See page 305*
Thatcher & Co., Geo. H., Albany, N. Y.
Townsend Furnace & Machine Shop Co., Albany, N. Y.
Treadwell Engineering Co., 140 Cedar St., New York, N. Y.
Union Iron Works, 15 Oak St., Bangor, Me.
Union Manufacturing Co., New Britain, Conn.
Vogt Machine Co., Henry, Louisville, Ky. *See page 55*
Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*
Watt Mining Car Wheel Co., Barnesville, O.
***Weimer Machine Works Co.**, Lebanon, Pa.
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*
Westbrook Elevator Co., Inc., Danville, Va.
West Coast Iron Works, 4601-9 14th Ave., N. W., Seattle, Wash.
***Wood & Co., R. D.**, Philadelphia, Pa. *See pages 204, 205*
Wood M. & R. M. Co., Walter A., Hoosick Falls, N. Y.
Youngstown Foundry & Machine Co., Youngstown, O.

Lead

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Malleable Iron

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
Malleable Iron Fittings Co., Branford, Conn. *See page 106*
Pressed Steel Car Co., Farmers Bank Bldg., Pittsburgh, Pa.
Stowell Co., So. Milwaukee, Wis.

Symington Co., T. H., 30 Church St., New York, N. Y.
Wood M. & R. M. Co., Walter A., Hoosick Falls, N. Y.

Manganese Steel

American Manganese Steel Co., 1850 McCormick Bldg., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

Monel Metal

Bayonne Casting Co., Bayonne, N. J.

Semi-Steel

Bellefonte Engineering Co., Bellefonte, Pa.
***Caldwell & Son Co.**, H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*
***Hill Clutch Co.**, Cleveland, O. *See page 148*
Malleable Iron Fittings Co., Branford, Conn. *See page 106*
Murray Iron Works Co., Burlington, Ia. *See page 16*
Phoenix Iron Works Co., Meadville, Pa. *See page 53*
***Pittsburgh Valve, Foundry & Construction Co.**, Pittsburgh, Pa. *See pages 102, 103*
Poole Engineering & Machine Co., Baltimore, Md.
***Wood & Co., R. D.**, Philadelphia, Pa. *See pages 204, 205*

Steel

American Steel Foundries, 1163 McCormick Bldg., Chicago, Ill.
Carroll Foundry & Machine Co., Bucyrus, O.
Chester Steel Castings Co., Chester, Pa.
Egan-Rogers Steel & Iron Co., Crum Lynne, Pa.
Falk Co., Milwaukee, Wis. *See pages 138, 139*
Loddell Car Wheel Co., Wilmington, Del.
Malleable Iron Fittings Co., Branford, Conn. *See page 106*
Maryland Iron & Steel Co., 15 Wall St., New York, N. Y.
Millbury Steel Foundry Co., Millbury, Mass.
National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*
Reading Steel Casting Co., Reading, Pa.
Reliance Steel Casting Co., 28th & Smallman Sts., Pittsburgh, Pa.
Treadwell Engineering Co., 140 Cedar St., New York, N. Y.
Union Spring & Mfg. Co., 2408 First Nat'l Bank, Pittsburgh, Pa.
Wheeling Mold & Foundry Co., Pittsburgh, Pa.

White Metal

***Doehler Die-Casting Co.**, Brooklyn, N. Y. *See page 263*
Moberg, Inc., C. J., Mt. Vernon, N. Y.
Van Wagner Mfg. Co., E. E., Syracuse, N. Y.
CAUSTICIZING APPARATUS
Zarembo Co., 707 D. S. Morgan Bldg., Buffalo, N. Y.

CEMENT

Asbestos

Hartford Covering Co., 1234 Main St., Hartford, Conn.

Belt

Alexander Brothers, 414 N. 3rd St., Philadelphia, Pa.
Bradford Belting Co., Cincinnati, O.
Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*
Jewell Belting Co., Hartford, Conn.
Laurence Belting Co., 111 Chambers St., New York, N. Y.
McCauley Belting Co., 212-220 Orleans St., Chicago, Ill.

Cas

Palmer & Co., N., Bridgeport, Conn.
 *Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*
 Shultz Belting Co., St. Louis, Mo. *See page 171*

Iron and Steel

Clark Cast Steel Cement Co., Shelton, Conn.
 Smooth-on Mfg. Co., 570-574 Communipaw Ave., Jersey City, N. J.

Pipe Joint

Clark Cast Steel Cement Co., Shelton, Conn.
 *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Hartford Covering Co., 1234 Main St., Hartford, Conn.
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Refractory

Betson Plastic Fire Brick Co., Rome, N. Y.
 *Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
 Quigley Furnace Specialties Co., Inc., 26 Cortlandt St., New York, N. Y.

Waterproof

Smooth-on Mfg. Co., 570-574 Communipaw Ave., Jersey City, N. J.

CEMENT MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 69*
 Reeves Bro. Co., Alliance, O.
 Traylor Engineering & Mfg. Co., Allentown, Pa.
 Vulcan Iron Works, Wilkes-Barre, Pa.
 Worthington Pump & Mch. Corp'n (Power & Mining Mch. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

CEMENT TESTING MACHINES

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*
 Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

CENTERING MACHINES

Binghamton Machine Works, 38 Chenango St., Binghamton, N. Y.
 Whiton Machine Co., D. E., New London, Conn.

CENTERS**Index**

Willard Machine & Tool Co., Cincinnati, O.

Planer

Cincinnati Planer Co., Oakley, Cincinnati, O. *See page 228*

CENTRIFUGAL PUMPS, SEPARATORS, ETC.

(*See Pumps, Separators, etc., Centrifugal*)

CENTRIFUGALS

Tolhurst Machine Works, Troy, N. Y.

Oil and Waste

D'Olier Centrifugal Pump & Machine Co., Morris Bldg., Philadelphia, Pa.
 National Separator & Machine Co., 89 State St., Boston, Mass.
 Oil and Waste Saving Machine Co., 1509 Real Estate Trust Bldg., Philadelphia, Pa. *See page 130*

CHAIN BELTS AND LINKS

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 *Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*
 *Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.
 *Link-Belt Co., Chicago, Ill. *See page 178*
 Mey Chain Belt Co., 82 Washington St., Buffalo, N. Y.
 Stowell Co., So. Milwaukee, Wis.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

CHAIN GRATE STOKERS

(*See Stokers, Chain Grate*)

CHAIN HOISTS

(*See Hoists, Chain*)

CHAIN MACHINES

Baird Machine Co., Bridgeport, Conn.

CHAIN SLINGS

(*See Slings, Chain*)

CHAIN TESTING MACHINES

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*
 Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

CHAINS**Ball**

Durbrow & Hearne Mfg. Co., 12 Wooster St., New York, N. Y.

Block or Pocket Wheel

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Cable

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Coil

Standard Chain Co., Pittsburgh, Pa.

Crane

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Weimer Chain & Iron Co., Lebanon, Pa.
 Woodhouse Chain Works, Trenton, N. J.

Dredge

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*
 Standard Chain Co., Pittsburgh, Pa.

Pump

Garland Nut & Rivet Co., West Pittsburgh, Pa.

Quarry

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Rivetless

Cross Engineering Co., Carbondale, Pa.

Steam Shovel

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Weimer Chain & Iron Co., Lebanon, Pa.
 Woodhouse Chain Works, Trenton, N. J.

Transmission

American Highspeed Chain Co., 401 S. Illinois St., Indianapolis, Ind.
 Baldwin Chain & Mfg. Co., 199 Chandler St., Worcester, Mass.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 Craig Mfg. Co., Cedar Rapids, Ia.
 Diamond Chain & Mfg. Co., 241 W. Georgia St., Indianapolis, Ind.
 Duckworth Chain & Mfg. Co., Springfield, Mass.

*Link-Belt Co., Chicago, Ill. *See page 178*
 Morse Chain Co., Ithaca, N. Y.
 Whitney Mfg. Co., Hartford, Conn.

Wire, Weldless

Bridgeport Chain Co., Bridgeport, Conn.

CHAMFERING MACHINES, TOOTH

Ingle Machine Co., 371-383 St. Paul St., Rochester, N. Y.

CHANNEL FORMING MACHINERY

Yoder Co., 1024 B. of L. E. Bldg., Cleveland, O.

CHANNELING MACHINES, MINE AND QUARRY

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

See Catalogue Section for data of firms listed in bold face type

CHARGING MACHINES, FURNACE

*Alliance Machine Co., Alliance, O. *See page 188*

CHEMICAL APPARATUS

Abbé Engineering Co., 220 Broadway, New York, N. Y.
Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.
Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.
Oat & Sons, Joseph, 232 Quarry St., Philadelphia, Pa.
Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

CHEMICALS

Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

CHIMNEYS**Brick (Radial)**

Bergen & Lindeman, Inc., 191 Broadway, New York, N. Y.
Custodis Chimney Construction Co., Alphons, 95 Nassau St., New York, N. Y.
Heine Chimney Co., 123 W. Madison St., Chicago, Ill.
Heinicke, Inc., H. R., 147 Fourth Ave., New York, N. Y.
Wiederholdt Construction Co., 620 Bank of Commerce Bldg., St. Louis, Mo.

Concrete

Heine Chimney Co., 123 W. Madison St., Chicago, Ill.
Kellogg Co., M. W., 92 West St., New York, N. Y.
Wiederholdt Construction Co., 620 Bank of Commerce Bldg., St. Louis, Mo.

Steel

(*See Stacks, Steel*)

Cha CHIPPERS**Ground Wood, Frozen**

Carthage Machine Co., Carthage, N. Y.

Pulp Wood

Carthage Machine Co., Carthage, N. Y.

CHUCKING MACHINES**Automatic Multiple-Spindle**

New Britain Machine Co., New Britain, Conn.

Heavy Duty

International Machine Tool Co., Indianapolis, Ind.

Turret

Quint Turret Drill Works, 8 Clinton St., Hartford, Conn.

CHUCKS**Air-Operated**

Hannifin Mfg. Co., Chicago, Ill.

Drill

Almond Mfg. Co., T. R., Ashburnham, Mass.
Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn. *See pages 250, 251, 252*

Horton & Son Co., E., Windsor Locks, Conn.
McCroskey Reamer Co., Meadville, Pa. *See pages 246, 247*

Modern Tool Co., Erie, Pa. *See page 244*
Narragansett Machine Co., Providence, R. I.
Oneida National Chuck Co., Oneida, N. Y.
Pratt Chuck Co., Frankfort, N. Y.
Skinner Chuck Co., New Britain, Conn.
Swedish Gage Co., Inc., Locomobile Bldg., New York, N. Y.

Trump Bros. Machine Co., Beech & Anchor-age Sts., Wilmington, Del.

Wahlstrom Tool Co., 346 Carroll St., Brooklyn, N. Y.
Westcott Chuck Co., Oneida, N. Y.

Lathe

Almond Mfg. Co., T. R., Ashburnham, Mass.
Cushman Chuck Co., Hartford, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn. *See pages 250, 251, 252*
Horton & Son Co., E., Windsor Locks, Conn.
Modern Tool Co., Erie, Pa. *See page 244*
Oneida National Chuck Co., Oneida, N. Y.
Skinner Chuck Co., New Britain, Conn.
Union Manufacturing Co., New Britain, Conn.
Westcott Chuck Co., Oneida, N. Y.
Whiton Machine Co., D. E., New London, Conn.

Magnetic

D & W Fuse Co., Providence, R. I. *See page 253*

*Heald Machine Co., Worcester, Mass.

Persons-Arter Machine Co., 72 Commercial St., Worcester, Mass.

Walker Co., O. S., Worcester, Mass.

Planer

Cincinnati Planer Co., Oakley, Cincinnati, O. *See page 228*

Hoggson & Pettis Mfg. Co., New Haven, Conn. *See pages 250, 251, 252*

Horton & Son Co., E., Windsor Locks, Conn.
Skinner Chuck Co., New Britain, Conn.

Tapping

Bicknell-Thomas Co., Greenfield, Mass.
Peter Bros. Mfg. Co., Algonquin, Ill.
St. Louis Machine Tool Co., 2807 S. Broadway, St. Louis, Mo.

CHUTES

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

*Link Belt Co., Chicago, Ill. *See page 178*

Willcox Engineering Co., Saginaw, Mich. *See page 317*

Gravity (Spiral)

Alvey Mfg. Co., St. Louis, Mo.
Haslett Spiral Chute Co., 1937 W. Tioga St., Philadelphia, Pa.

Lowerator Co., Inc., 631 Kent Ave., Brooklyn, N. Y.

Mathews Gravity Carrier Co., Ellwood City, Pa.

Minnesota Manufacturers' Assn., North St. Paul, Minn.

Moore & Lorenz Co., 2144-52 W. Fulton St., Chicago, Ill.

Skilling & Richards Mfg. Co., 4520 Cortland St., Chicago, Ill.

CIGARETTE MACHINERY

Miller, DuBrul & Peters Mfg. Co., 507 E. Pearl St., Cincinnati, O.

CIGAR MACHINERY

Miller, DuBrul & Peters Mfg. Co., 507 E. Pearl St., Cincinnati, O.

CIRCUIT BREAKERS

Condit Electrical Mfg. Co., South Boston, Mass.

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Roller-Smith Co., 233 Broadway, New York, N. Y.

CIRCULATORS**Feed Water**

Bloomsburg & Co., H., 425 N. Carey St., Baltimore, Md.

Eckliff Automatic Boiler Circulator Co., Detroit, Mich.

McNab Co., Bridgeport, Conn.

Uniflow Boiler Co., Inc., 2 S. 15th St., Philadelphia, Pa.

Waters Co., Geo. H., Mariners Harbor, N. Y.

Steam Heating

Bloomsburg & Co., H., 425 No. Carey St., Baltimore, Md.

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

Water (High Pressure)

Taylor Steam Specialty Co., Battle Creek, Mich. *See page 114*

CLAMPING DEVICES (Air-operated)
Hannifin Mfg. Co., Chicago, Ill.**CLAMPS****Belt**

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

Cable

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*

Ground

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*

Guy

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*
Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Pipe

Power Plant Specialties, 219 Ruffner St., Lockland, O.
Skinner & Co., M. B., 562 Washington Blvd., Chicago, Ill.

Wire Rope

(See Wire Rope Fastenings)

CLASSIFIERS

Dorr Co., 1009—17th St., Denver, Colo.

CLAY, FIRE

Ashland Fire Brick Co., Ashland, Ky.
Betsen Plastic Fire Brick Co., Rome, N. Y.
Pyro Clay Products Co., Oak Hill, O.
Taylor Sons Co., Chas., Cincinnati, O.

CLAY WORKING MACHINERY

American Clay Machinery Co., Bucyrus, O.
Chambers Bros. Co., 52nd & Media Sts., Philadelphia, Pa.
Fate Co., J. D., Plymouth, O.
Patterson Foundry & Machine Co., East Liverpool, O.
Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

CLEVISSES

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

CLIPPERS, VENEER

Merritt Mfg. Co., Lockport, N. Y.

CLOCKS, WATCHMEN'S

Newman Clock Co., 178 Fulton St., New York, N. Y. *See page 336*

CLOTH, PAPER, RUBBER, ETC., TESTING MACHINES

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*
Perkins & Son, Inc., B. F., Holyoke, Mass.
Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

CLUTCHES**Automobile**

Brown-Lipe Gear Co., 1117 West Fayette St., Syracuse, N. Y.
Detroit Gear & Machine Co., 127 Franklin St., Detroit, Mich.
Hilliard Clutch & Machinery Co., Elmira, N. Y.

Friction

American Clutch Mfg. Co., 3541 Washington St., Boston, Mass.
Bicknell-Thomas Co., Greenfield, Mass.

Blevney, John C., Newark, N. J.

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
Carruthers Fithian Clutch Co., Grove City, Pa.

Conway & Co., Cincinnati, O.
Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

Dornfeld Iron Works, Watertown, Wis.
Edgemont Machine Co., Dayton, O.
Erie Clutch & Pulley Co., 1906 Holland St., Erie, Pa.

*Falls Clutch & Machinery Co., Cuyahoga Falls, O. *See page 143*

Fremont Clutch Co., Fremont, O.
Havana Mfg. Co., Havana, Ill.

*Hill Clutch Co., Cleveland, O. *See page 148*
Hilliard Clutch & Machinery Co., Elmira, N. Y.

Johnson Machine Co., Carlyle, 52 Main St., Manchester, Conn.

Link-Belt Co., Chicago, Ill. *See page 178*
Mason & Co., Inc., Volney W., 2 Lafayette St., Providence, R. I.

McMahon & Co., Worcester, Mass.
Minster Machine Co., Minster, O.

*Moore & White Co., Philadelphia, Pa. *See page 149*
Never Slip Clutch Co., Noblesville, Ind.

O. K. Clutch & Machine Co., Second & Linden Sts., Columbia, Pa.

Plamondon Mfg. Co., A., 24 N. Clinton St., Chicago, Ill.

Reeves Pulley Co., Columbus, Ind.

Schultz & Son, A. L., 1675 Elston Ave., Chicago, Ill.

Standard Pulley Co., 1734 Powers St., Cincinnati, O.

Thomas Coupling Co., Troy, Pa.
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Williams Foundry & Machine Co., Akron, O.

*Wood's Sons Co., T. B., Chambersburg, Pa. *See pages 150, 151*

Yocum & Son, James, 145 N. Second St., Philadelphia, Pa.

Magnetic

Cutler-Hammer Mfg. Co., Milwaukee, Wis.

COAL AND ASH HANDLING MACHINERY

Alvey-Ferguson Co., Cincinnati, O.

American Conveyor Co., 6611 Drexel Ave., Chicago, Ill.

Bartlett & Snow Co., C. O., Cleveland, O.

Beaumont Co., R. H., Drexel Bldg., Philadelphia, Pa.

Bergen Point Iron Works, West 5th St., Bayonne, N. J.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 170, 177*

Gifford-Wood Co., Hudson, N. Y.

*Green Engineering Co., East Chicago, Ind. *See pages 64, 65*

Guarantee Construction Co., 90 West St., New York, N. Y.

Hayward Co., 50 Church St., New York, N. Y.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

Illinois Stoker Co., Alton, Ill.

*Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.

*Lidgerwood Mfg. Co., 90 Liberty St., New York, N. Y. *See page 191*

Link-Belt Co., Chicago, Ill. *See page 178*

*Locomotive Pulverized Fuel Co., 30 Church St., New York, N. Y.

Mead Morrison Mfg. Co., East Boston, Mass.

Specialty Engineering Co., Allegheny & Trenton Aves., Phila., Pa.

Stephens-Adamson Mfg. Co., Aurora, Ill.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Coa

See Catalogue Section for data of firms listed in bold face type

COAL BRIQUETTING MACHINERY

Mashek Engineering Co., 90 West St., New York, N. Y.

COAL CLEANERS

Pennsylvania Crusher Co., Stephen Girard Bldg., Philadelphia, Pa.

COAL MINING MACHINERY

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. See pages 272, 273

Kokomo Foundry & Machine Co., Kokomo, Ind.

COAL PREPARING EQUIPMENT

Cross Engineering Co., Carbondale, Pa.
Fairmont Mining Machinery Co., Fairmont, W. Va.

Pittsburgh Coal Washer Co., 812 Fulton Bldg., Pittsburgh, Pa.
Tamaqua Mfg. Co., Tamaqua, Pa.

COAL PUSHERS, MECHANICAL

Locomotive Stoker Co., North Side, Pittsburgh, Pa.

COAL WASHERS

Pittsburgh Coal Washer Co., 812 Fulton Bldg., Pittsburgh, Pa.

COALING STATIONS, LOCOMOTIVE

Beaumont Co., R. H., Drexel Bldg., Philadelphia, Pa.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. See pages 186, 187
Link-Belt Co., Chicago, Ill. See page 178
Williams, White & Co., Moline, Ill. See page 215

COATING MACHINERY

Knowlton Co., M. D., Rochester, N. Y.

COCKS, AIR AND GAGE

American Injector Co., Detroit, Mich. See page 116

American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322

*Ashton Valve Co., 271 Franklin St., Boston, Mass. See page 323

Bonar & Co., James, 502 Park Bldg., Pittsburgh, Pa.

Cadman Mfg. Co., A. W., 2814-2816 Smallman St., Pittsburgh, Pa.

Chaplin-Fulton Mfg. Co., 28-34 Penn Ave., Pittsburgh, Pa.

*Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91

Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324

Detroit Brass Works, Detroit, Mich.

Detroit Lubricator Co., Detroit, Mich. See page 125

*Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97

Kelly & Jones Co., Greensburg, Pa. See pages 94, 95

Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325

Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.

Penberthy Injector Co., Detroit, Mich. See page 117

Rich Mfg. Co., 370 Atlantic Ave., Boston, Mass.

"S-C" Regulator Co., Fostoria, O.

Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Williams Gauge Co., 543 Fourth Ave., Pittsburgh, Pa.

Blowoff

*Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91

Eastwood Wire Mfg. Co., Belleville, N. J.

*Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa. See page 93

Judson Governor Co., Rochester, N. Y.

Kelly & Jones Co., Greensburg, Pa. See pages 94, 95

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103

Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101

Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Cylinder

Watertown Specialty Co., Watertown, N. Y.

Three-Way and Four-Way

American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322

*Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91

Glenn, Clifford C., 1934 Fremont St., Chicago, Ill.

*Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa. See page 93

Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103

Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101

COFFEE MACHINERY

Squier Mfg. Co., Geo. L., Buffalo, N. Y.

COILS, PIPE

Best Co., 3221 Spruce Way, Pittsburgh, Pa.

*National Pipe Bending Co., New Haven, Conn. See pages 78, 79

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103

Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Simmons Pipe Bending Works, 40 Mechanic St., Newark, N. J.

Refrigerating

Brunswick Refrigerating Co., New Brunswick, N. J.

*Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. See page 277

Vogt Machine Co., Henry, Louisville, Ky. See page 55

COKE OVEN MACHINERY

*Alliance Machine Co., Alliance, O. See page 188

COLD ROLLING MACHINERY

Blake & Johnson Co., Waterbury, Conn. See page 235

COLD STORAGE PLANTS

Armstrong Machinery Co., 3201-3219 East Riverside, Spokane, Wash.

*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. See page 25

COLLARS, SHAFT

Automatic Shaft Coupling Co., Real Estate Trust Bldg., Washington, D. C.

Bond Foundry & Machine Co., Manheim, Lancaster Co., Pa.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. See page 174

*Chain Belt Co., 734 Park St., Milwaukee, Wis. See pages 176, 177

Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147

*Hill Clutch Co., Cleveland, O. See page 148

Middletown Machine Co., Middletown, O.

Pittsburgh Grinding Wheel Co., Rochester, Pa.

*Rorysford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. See pages 152, 153

Standard Pressed Steel Co., Philadelphia, Pa.

*Wood's Sons Co., T. B., Chambersburg, Pa. See pages 150, 151

COLLECTING SYSTEMS, DUST

Clark Dust Collecting Co., 1116 Fisher Bldg., Chicago, Ill.

Dixie Mfg. Co., Inc., Baltimore, Md.

Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.

Coa

COLLETS

Hardinge Brothers, Inc., 1770 Breteau Ave., Chicago, Ill.
McCrosky Reamer Co., Meadville, Pa. *See pages 246, 247*

COLORING

American Metal Treatment Co., Elizabeth, N. J.

COLUMNS AND BASES, STRUCTURAL

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

COMBUSTION CHAMBER ARCHES

(See Arches, Combustion Chamber)

COMBUSTION (CO₂) RECORDERS

Combustion Appliances Co., 1778 Estes Ave., Chicago, Ill.

***Defender Automatic Regulator Co.**, 506 Oriel Bldg., St. Louis, Mo. *See page 319*

Pierce Co., William B., 45 N. Division St., Buffalo, N. Y.

***Precision Instrument Co.**, Detroit, Mich. *See page 320*

Simonds & Co., G. L., 230 S. La Salle St., Chicago, Ill.

Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. *See page 321*

COMPOUNDS**Boiler**

Arrow Boiler Compound Co., 703-715 Roe Bldg., St. Louis, Mo.

Binghamton Boiler Compound Co., Binghamton, N. Y.

Bird-Archer Co., 90 West St., New York, N. Y.

Black Bear Co., 138-144 Temple St., Long Island City, N. Y.

Columbia Graphite Co., Cleveland, O.

Dearborn Chemical Co., McCormick Bldg., Chicago, Ill.

Hawk-Eye Compound Co., 257 W. 63rd St., Chicago, Ill.

International Boiler Cleaning Co., 341-343 N. Calvert St., Baltimore, Md.

International Boiler Compound Co., 144 W. Austria Ave., Chicago, Ill.

Kramer Oil Co., W. J., Milwaukee, Wis.

McVicker Co., W. B., 115 Broadway, New York, N. Y.

Metalene Chemical Co., Cleveland, O.

National Boiler Specialties Co., Elgin, Ill.

North American Chemical & Engineering Co., 23 Old Slip, New York, N. Y.

Permutit Co., 30 E. 42nd St., New York, N. Y.

Perolin Co. of America, 1112 W. 32nd St., Chicago, Ill.

Standard Chemical Co., Kalamazoo, Mich.

Star Oil Co., 440 N. Halsted St., Chicago, Ill.

Warley & Co., Thos. C., 227 S. Front St., Philadelphia, Pa.

Young's Boiler Compound Co., Catsasauqua, Pa.

Casehardening

Metal Hardening Solution Co., Rochester, N. Y.

Cutting

Moore Oil Co., Cincinnati, O.

Warley & Co., Thos. C., 227 S. Front St., Philadelphia, Pa.

Elevator

Warley & Co., Thos. C., 227 S. Front St., Philadelphia, Pa.

Grinding

Jones Ball Co., Arlington Heights, Mass.

Hardening, Selective

Shore Instrument & Mfg. Co., Inc., 557 W. 22nd St., New York, N. Y.

Hydraulic Elevator

McVicker Co., W. B., 115 Broadway, New York, N. Y.

Slushing

Warren Brothers Co., 142 Berkeley St., Boston, Mass.

Tempering

Metal Hardening Solution Co., Rochester, N. Y.

COMPRESSED AIR METERS

(See Meters, Compressed Air)

COMPRESSOR OUTFITS, AIR

Black & Decker Mfg. Co., 105-15 S. Calvert St., Baltimore, Md.

Miller Improved Gas Engine Co., Springfield, O.

National Brake & Electrical Co., Milwaukee, Wis. *See pages 278, 279*

Novo Engine Co., Lansing, Mich.

COMPRESSORS**Air**

Air Device Mfg. Co., 5702 S. State St., Chicago, Ill.

American Compressor & Pump Co., 801-5 E. Pratt St., Baltimore, Md.

American Steam Pump Co., Battle Creek, Mich.

Bessemer Gas Engine Co., Grove City, Pa.

Blaisdell Machinery Co., Bradford, Pa.

Blakeslee Mfg. Co., Du Quoin, Ill.

Brunner Mfg. Co., Utica, N. Y.

Bury Compressor Co., Erie, Pa.

Carruthers Fithian Clutch Co., Grove City, Pa.

Chicago Pneumatic Tool Co., 1010 Fisher Bldg., Chicago, Ill.

Christensen Engineering Co., 841 30th St., Milwaukee, Wis.

Clark & Norton Mfg. Co., Wellsville, N. Y.

Clothel Co., 61 Broadway, New York, N. Y.

Crowell Mfg. Co., 298 Taaffe Place, Brooklyn, N. Y.

Curtis Pneumatic Machinery Co., St. Louis, Mo.

Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*

Gardner Governor Co., Quincy, Ill. *See page 274*

***General Electric Co.**, Schenectady, N. Y. *See pages 30, 31*

Hall Steam Pump Co., Pittsburgh, Pa.

Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*

*Hooven, Owens, Rentschler Co., Hamilton, O.

Indiana Air Pump Co., 812 Indiana Pythian Bldg., Indianapolis, Ind.

***Ingersoll-Rand Co.**, 11 Broadway, New York, N. Y. *See pages 272, 273*

Jackson Compressor Co., 1130 12th St., Denver, Colo.

Jacobson Machine Mfg. Co., Warren, Pa.

***Mesta Machine Co.**, Pittsburgh, Pa.

Mietz Machine Works, August, 123 Mott St., New York, N. Y. *See page 27*

Murray Iron Works Co., Burlington, Ia. *See page 16*

Nagle Corliss Engine Works, Erie, Pa.

Nash Engineering Co., South Norwalk, Conn.

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

New London Ship & Engine Co., Groton, Conn. *See page 23*

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Norwalk Iron Works Co., So. Norwalk, Conn. *See page 275*

Platt Iron Works, Dayton, O. *See page 290*

Rix Compressed Air & Drill Co., 505 Howard St., San Francisco, Cal.

Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283*

***Southwark Foundry & Machine Co.**, Philadelphia, Pa. *See page 24*

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

Trauter Mfg. Co., Pittsburgh, Pa.

Turbine Equipment Co., 50 Church St., New York, N. Y.

Union Steam Pump Co., Battle Creek, Mich.

See Catalogue Section for data of firms listed in bold face type

COMPRESSORS (continued)**Air**

Utility Compressor Co., 355 Harper Ave., Detroit, Mich.

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Clayton Works, Laidlaw Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Air, Compound

Gardner Governor Co., Quincy, Ill. *See page 274*

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Murray Iron Works Co., Burlington, Ia. *See page 16*

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Norwalk Iron Works Co., So. Norwalk, Conn. *See page 275*

Rix Compressed Air & Drill Co., 505 Howard St., San Francisco, Cal.

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Laidlaw Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Ammonia

Mayer Ice Machine & Engineering Co., Morris St. & Hudson River, Jersey City, N. J.

*Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*

Gas

Blaisdell Machinery Co., Bradford, Pa.

Bury Compressor Co., Erie, Pa.

Clark & Norton Mfg. Co., Wellsville, N. Y.

Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*

Hope Engineering & Supply Co., Pittsburgh, Pa.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

*Mesta Machine Co., Pittsburgh, Pa.

Murray Iron Works Co., Burlington, Ia. *See page 16*

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Norwalk Iron Works Co., So. Norwalk, Conn. *See page 275*

Platt Iron Works, Dayton, O. *See page 290*

*Roots Co., P. H. & F. M., Connerville, Ind. *See pages 282, 283*

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Utility Compressor Co., 355 Harper Ave., Detroit, Mich.

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Laidlaw Works, Snow Plant), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

CONCENTRATING MACHINERY

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

CONCRETE FLOOR HARDENER

*Sonneborn Sons, Inc., L., 262 Pearl St., New York, N. Y.

CONCRETE GRAVITY PLANTS

Insley Mfg. Co., Indianapolis, Ind.

Ransome Concrete Machinery Co., Dunellen, N. J.

CONCRETE MIXING MACHINES

(See Mixers, Concrete)

CONCRETE REINFORCEMENT (Mesh)

Clinton Wire Cloth Co., Clinton, Mass.

CONDENSATION RETURN SYSTEMS, GRAVITY

Hobson, Russell B., 455 Kessel Ave., New Brighton, N. Y.

CONDENSER TUBES

(See Tubes, Condenser)

CONDENSERS

Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*

Ammonia

*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*

Frick Co., Waynesboro, Pa.

*Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*

Vogt Machine Co., Henry, Louisville, Ky. *See page 55*

Barometric

Blake Pump & Condenser Co., Fitchburg, Mass.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Kellogg Co., M. W., 92 West St., New York, N. Y.

*Mesta Machine Co., Pittsburgh, Pa.

Platt Iron Works, Dayton, O. *See page 290*

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Tod Co., William S., Phelps St., Youngstown, O.

Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Jet

American Steam Pump Co., Battle Creek, Mich.

Blake Pump & Condenser Co., Fitchburg, Mass.

Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*

*Davidson Co., M. T., 43 Keap St., Brooklyn, N. Y.

Dean Bros. Steam Pump Works, Indianapolis, Ind.

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

Murray Iron Works Co., Burlington, Ia. *See page 16*

Platt Iron Works, Dayton, O. *See page 290*

*Schutte & Koerting Co., 12th & Thompson Sts., Philadelphia, Pa.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Deane Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Jet, Rotary

Manistee Iron Works Co., Manistee, Mich. *See page 287*

Surface

Alberger Pump & Condenser Co., 140 Cedar St., New York, N. Y.

Baraganath & Son, Wm., 1260 W. Division St., Chicago, Ill.

Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

Murray Iron Works Co., Burlington, Ia. *See page 16*

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Platt Iron Works, Dayton, O. *See page 290*

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

***Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

Wheeler Condenser & Engineering Co., Carteret, N. J.

Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

CONDUIT

***American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*

***Johns-Manville Co.**, H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Air (Canvas)

Bemis Bro. Bag Co., St. Louis, Mo.

CONNECTING RODS

Leard, Wm. E., New Brighton, Pa.

Williams & Co., J. H., Brooklyn, N. Y.

CONSISTOMETERS

Chatillon & Sons, John, 85-93 Cliff St., New York, N. Y. *See page 315*

CONTAINERS (For Heat Treatment Processes)

Garwood Bronze & Iron Works, Garwood, N. J.

CONTROL SETS, AUTOMOBILE

Brown-Lipe Gear Co., 1117 West Fayette St., Syracuse, N. Y.

CONTROLLERS

Automatic, for Temperature or for Pressure (See Regulators)

Electric

Cutler-Hammer Mfg. Co., Milwaukee, Wis.

Electric Controller & Mfg. Co., Cleveland, O.

***General Electric Co.**, Schenectady, N. Y. *See pages 30, 31*

General Elevator Co., 29 Broadway, New York, N. Y.

***Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

Elevator

Maintenance Co., 417-421 Canal St., New York, N. Y.

Wheeler-McDowell Elevator Co., 417 Canal St., New York, N. Y.

Elevator Signal

Kingsbridge Machine Works, Kingsbridge, New York, N. Y.

Feed Water

(See Regulators, Feed Water)

Filter Rate

Simplex Valve & Meter Co., 112 N. Broad St., Philadelphia, Pa.

Liquid Level

Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*

Time

Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*

CONVERTERS

Rotary

***General Electric Co.**, Schenectady, N. Y. *See pages 30, 31*

Wagner Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.

***Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

Steel

Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*

CONVEYING MACHINERY

Alvey-Ferguson Co., Cincinnati, O.

Alvey Mfg. Co., St. Louis, Mo.

American Conveyor Co., 6611 Drexel Ave., Chicago, Ill.

Bay City Foundry & Machine Co., Bay City, Mich.

Beaumont Co., R. H., Drexel Bldg., Philadelphia, Pa.

***Chain Belt Co.**, 734 Park St., Milwaukee, Wis. *See pages 176, 177*

Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*

Dull Co., Raymond W., 111 W. Washington St., Chicago, Ill.

Garland Co., M., Bay City, Mich.

***Hill Clutch Co.**, Cleveland, O. *See page 148*

***Hunt Co., Inc.**, C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

Lamson Co., 100 Boylston St., Boston, Mass. *See pages 184, 185*

Link-Belt Co., Chicago, Ill. *See page 178*

Philadelphia Tramrail Co., Front & Tusculum Sts., Philadelphia, Pa. *See page 194*

Specialty Engineering Co., Allegheny & Trenton Aves., Phila., Pa.

Standard Sand & Machine Co., Cleveland, O.

Stephens-Adamson Mfg. Co., Aurora, Ill.

Union Iron Works, Decatur, Ill.

Webster Mfg. Co., Tiffin, O.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

CONVEYING SYSTEMS, PNEUMATIC

Allington & Curtis Mfg. Co., 402 Holden St., Saginaw, Mich.

Light Material

American Blower Co., Detroit, Mich. *See pages 280, 281*

Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

CONVEYING WEIGHERS

(See Weighers, Conveying)

CONVEYOR BELT DRIVER (Differential Gear)

Holmes & Bros., Rob't, Danville, Ill.

CONVEYORS

Belt

Alvey Mfg. Co., St. Louis, Mo.

***Caldwell & Son Co.**, H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*

Haslett Spiral Chute Co., 1937 W. Tioga St., Philadelphia, Pa.

Lamson Co., 100 Boylston St., Boston, Mass. *See pages 184, 185*

Link-Belt Co., Chicago, Ill. *See page 178*

Robins Conveying Belt Co., Park Row Bldg., New York, N. Y.

Stephens-Adamson Mfg. Co., Aurora, Ill.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Bucket, Pan or Apron

***Caldwell & Son Co.**, H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

***Chain Belt Co.**, 734 Park St., Milwaukee, Wis. *See pages 176, 177*

Gifford-Wood Co., Hudson, N. Y.

***Hunt Co., Inc.**, C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

Link-Belt Co., Chicago, Ill. *See page 178*

Mead Morrison Mfg. Co., East Boston, Mass.

Sturtevant Mill Co., Harrison Sq., Boston Mass.

Webster Mfg. Co., Tiffin, O.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Gravity (Roller)

Alvey Mfg. Co., St. Louis, Mo.

Haslett Spiral Chute Co., 1937 W. Tioga St., Philadelphia, Pa.

Lamson Co., 100 Boylston St., Boston, Mass. *See pages 184, 185*

Lowerator Co., Inc., 631 Kent Ave., Brooklyn, N. Y.

Mathews Gravity Carrier Co., Ellwood City, Pa.

Con

See Catalogue Section for data of firms listed in bold face type

CONVEYORS (continued)**Gravity (Roller)**

Minnesota Manufacturers' Assn., North St.
Paul, Minn.

Portable

Brown Portable Elevator Co., Chicago, Ill.
See page 179

Screw

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*
Link-Belt Co., Chicago, Ill. *See page 178*
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Spiral

(See Chutes, Gravity, Spiral)

Tray (Automatic)

Lamson Co., 100 Boylston St., Boston, Mass.
See pages 184, 185

COOKERS

American Process Co., 68 William St., New York, N. Y.

COOLERS**Brine**

Frick Co., Waynesboro, Pa.

Oil

American Spray Co., 26 Cortlandt St., New York, N. Y.
Ross Heater & Mfg. Co., Inc., 753 Bird Ave., Buffalo, N. Y.

COOLING PONDS

Carrier Air Conditioning Co., 490 Broadway, Buffalo, N. Y.

Spray

American Spray Co., 26 Cortlandt St., New York, N. Y.

*Schutte & Koerting Co., 12th & Thompson Sts., Philadelphia, Pa.

CON COOLING TOWERS (Natural and Forced Draft)

Burham Co., Edwin, 71 Wall St., New York, N. Y.

Cooling Tower Co., 50 Broad St., New York, N. Y.

Murray Iron Works Co., Burlington, Ia.
See page 16

Ruemmell-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.

*Spray Engineering Co., 93 Federal St., Boston, Mass. *See page 87*

Wheeler Condenser & Engineering Co., Carteret, N. J.

Wheeler Mfg. Co., C. H., Philadelphia, Pa.
See page 85

Worthington Pump & Mch. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

COOPERAGE MACHINERY

Strait Mfg. Co., N. H., Kansas City, Kans.

COPING MACHINES

Long & Allstatter Co., Hamilton, O. *See page 213*

Williams, White & Co., Moline, Ill. *See page 215*

COPPER**Drawn**

American Brass Co., Waterbury, Conn. *See page 204*

*Roebbing's Sons Co., John A., Trenton, N. J. *See page 172*

Sheet

New Haven Copper Co., Seymour, Conn.

COPPER CONVERTING MACHINERY

*Alliance Machine Co., Alliance, O. *See page 188*

COPPER SCRAPING MACHINES

Poole Engineering & Machine Co., Baltimore, Md.

COPPER WIRES AND CABLES

(See Wire and Cables, Electrical)

COPPER WORK

Harris & Co., Arthur, 212 Curtis St., Chicago, Ill.

CORK BOARD

Union Fibre Co., Winona, Minn.

CORUNDUM

(See Abrasive Materials)

CORUNDUM WHEELS

(See Grinding Wheels)

COTTON MACHINERY

Carver Cotton Gin Co., East Bridgewater, Mass.

Liddell Co., Charlotte, N. C.

Saco-Loell Shops, 77 Franklin St., Boston, Mass.

COUNTERS**Automatic**

Baird Equipment Co., 319-25 W. Ohio St., Chicago, Ill.

Durant Mfg. Co., Milwaukee, Wis. *See page 339*

Hart Mfg. Co., R. A., 21 Wilson Court, Battle Creek, Mich.

International Register Co., 15 S. Throop St., Chicago, Ill.

McDonnell Odometer Co., 35th & Kedzie Ave., Chicago, Ill.

National Scale Co., Chicopee Falls, Mass.

Redington Co., F. B., 112-114 So. Sangamon St., Chicago, Ill.

Root Co., C. J., 150 Bridge St., Bristol, Conn. *See page 340*

Tally-Meter Co., Norwich, Conn.

*Veeder Mfg. Co., Hartford, Conn. *See page 341*

Lineal Measure

Durant Mfg. Co., Milwaukee, Wis. *See page 339*

Tally-Meter Co., Norwich, Conn.

Revolution

American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*

*Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*

Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*

Durant Mfg. Co., Milwaukee, Wis. *See page 339*

Durbrow & Hearne Mfg. Co., 12 Wooster St., New York, N. Y.

Hart Mfg. Co., R. A., 21 Wilson Court, Battle Creek, Mich.

International Register Co., 15 S. Throop St., Chicago, Ill.

McNab Co., Bridgeport, Conn.

Root Co., C. J., 150 Bridge St., Bristol, Conn. *See page 340*

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*

*Veeder Mfg. Co., Hartford, Conn. *See page 341*

COUNTERSHAFTS

Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

*Hill Clutch Co., Cleveland, O. *See page 148*

Sloan & Chase Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*

Standard Pulley Co., 1734 Powers St., Cincinnati, O.

*Wood's Sons Co., T. B., Chambersburg, Pa. *See pages 150, 151*

Right Angle

Almond Mfg. Co., T. R., Ashburnham, Mass.

COUPLINGS**Flexible**

Bond Co., Charles, Philadelphia, Pa.

Bruce-Macbeth Engine Co., Cleveland, O.

*Hill Clutch Co., Cleveland, O. *See page 148*

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*

Roberts Elevator Co., James H., 430 W. Broadway, New York, N. Y.

***Roots Co., P. H. & F. M., Connersville, Ind.** *See pages 282, 283*

Smith-Serrell Co., Inc., 90 West St., New York, N. Y.

Thomas Coupling Co., Troy, Pa.

Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

Pipe

American District Steam Co., North Tonawanda, N. Y. *See page 118*

***Central Foundry Co., 90 West St., New York, N. Y.** *See page 105*

***Crane Co., 839 S. Michigan Ave., Chicago, Ill.** *See pages 88, 89, 90, 91*

Dole Valve Co., 208 N. Fifth Ave., Chicago, Ill.

Hope Engineering & Supply Co., Pittsburgh, Pa.

Jefferson Union Co., Lexington, Mass.

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Nott Iron & Brass Works, H. L., White River Junction, Vt.

***Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa.** *See pages 102, 103*

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Stoddard Union Co., Lockport, N. Y.

Shaft

Automatic Shaft Coupling Co., Real Estate Trust Bldg., Washington, D. C.

Bond Foundry & Machine Co., Manheim, Lancaster Co., Pa.

***Brown Co., A. & F., 79 Barclay St., New York, N. Y.** *See page 136*

***Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill.** *See page 174*

***Carruthers Fithian Clutch Co., Grove City, Pa.**

***Chain Belt Co., 734 Park St., Milwaukee, Wis.** *See pages 176, 177*

***Cumberland Steel Co., Cumberland, Md.**

***Dodge Sales & Engineering Co., Mishawaka, Ind.** *See pages 74, 144, 145, 146, 147*

***Falls Clutch & Machinery Co., Cuyahoga Falls, O.** *See page 143*

***Hill Clutch Co., Cleveland, O.** *See page 148*

Oneida Steel Pulley Co., 37 Cedar St., Oneida, N. Y.

***Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa.** *See pages 152, 153*

Smith-Serrell Co., Inc., 90 West St., New York, N. Y.

Stuart Foundry & Machine Works, R. J. & F. H., New Hamburg, N. Y.

Thomas Coupling Co., Troy, Pa.

Trauter Mfg. Co., Pittsburgh, Pa.

Waller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

***Wood's Sons Co., T. B., Chambersburg, Pa.** *See page 150, 151*

Union

Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

***Wood's Sons Co., T. B., Chambersburg, Pa.** *See pages 150, 151*

COVERINGS

Boiler Blowoff (Fire Clay)

Woolson, Orosco C., 39 Cortlandt St., New York, N. Y.

Pipe and Tank

Armstrong Cork & Insulation Co., 122 24th St., Pittsburgh, Pa. *See page 120*

Carey Co., Philip, Cincinnati, O. *See page 121*

Central Asbestos & Magnesia Co., 214-216 W. Grand Ave., Chicago, Ill.

Pulley

Shackley & Son Co., W. T., 49 High St., Boston, Mass.

Steam Pipe

Acme Asbestos Covering & Supply Co., 401 N. Ada St., Chicago, Ill.

American District Steam Co., North Tonawanda, N. Y. *See page 118*

Armstrong Cork & Insulation Co., 122 24th St., Pittsburgh, Pa. *See page 120*

Carey Co., Philip, Cincinnati, O. *See page 121*

Central Asbestos & Magnesia Co., 214-216 W. Grand Ave., Chicago, Ill.

Ehret Magnesia Mfg. Co., Valley Forge, Pa. *See page 121*

Franklin Mfg. Co., Franklin, Pa. *See page 121*

***Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y.** *See page 119*

Keasbey Co., Robert A., West & Bank Sts., New York, N. Y.

Keasbey & Mattison Co., Ambler, Pa. *See page 121*

National Air Cell Covering Co., 210-220 Van Brunt St., Brooklyn, N. Y.

Nightingale & Childs Co., 205 Congress St., Boston, Mass.

Richards-Wilson Pipe Covering Co., 325 Scribner Ave., Grand Rapids, Mich.

Sall Mountain Co., 230 S. La Salle St., Chicago, Ill.

Standard Asbestos Mfg. Co., Chicago, Ill.

Wyckoff & Son Co., A., Elmira, N. Y. *See pages 122, 291*

COVERS, TRENCH

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

CRANES

Electric Traveling

***Alliance Machine Co., Alliance, O.** *See page 188*

***Box & Co., Alfred, Philadelphia, Pa.**

Euclid Crane & Hoist Co., Euclid, O.

Hay's Sons, Sam'l W., 1408-9 Keenan Bldg., Pittsburgh, Pa.

Maris Brothers, Philadelphia, Pa.

***Morgan Engineering Co., Alliance, O.**

New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

***Northern Engineering Works, Detroit, Mich.**

Pawling & Harnischfeger Co., Milwaukee, Wis.

Roeper Crane & Hoist Works, Reading, Pa.

San Francisco Engineering Co., 322 & 324 6th St., San Francisco, Cal.

***Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.** *See page 192*

Stamp Co., Charles E., Cleveland, O.

***Toledo Bridge & Crane Co., Toledo, O.**

***Whiting Foundry Equipment Co., Harvey, Ill.**

Floor (Portable)

***Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y.** *See page 191*

Milton & Son, S. G., Franklin, Pa.

United Engine Mfg. Co., Hanover, Pa.

Gantry

***Alliance Machine Co., Alliance, O.** *See page 188*

Industrial Works, Bay City, Mich. *See page 189*

Link-Belt Co., Chicago, Ill. *See page 178*

New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*

Hand Power

Cameron Engineering Co., East Stroudsburg, Pa.

Chisholm-Moore Mfg. Co., Cleveland, O.

See Catalogue Section for data of firms listed in bold face type

CRANES (continued)**Hand Power**

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
- Curtis Pneumatic Machinery Co., St. Louis, Mo.
- Hay's Sons, Sam'l W., 1408-9 Keenan Bldg., Pittsburgh, Pa.
- *Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
- Maris Brothers, Philadelphia, Pa.
- Milton & Son, S. G., Franklin, Pa.
- New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*
- *Northern Engineering Works, Detroit, Mich.
- Roeper Crane & Hoist Works, Reading, Pa.
- *Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. *See page 192*
- Speidel, J. G., Reading, Pa.
- Stamp Co., Charles E., Cleveland, O.
- *Whiting Foundry Equipment Co., Harvey, Ill.
- Yale & Towne Mfg. Co., 9 E. 40th St., New York, N. Y.

Hydraulic

- *Alliance Machine Co., Alliance, O. *See page 188*
- Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*
- *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Jib

- *Alliance Machine Co., Alliance, O. *See page 188*
- New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*
- *Northern Engineering Works, Detroit, Mich.
- Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. *See page 192*
- Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*
- *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Locomotive

- American Hoist & Derrick Co., St. Paul, Minn.
- *Brown Hoisting Machinery Co., Cleveland, O.
- Browning Co., Cleveland, O.
- Byers Machine Co., John F., Ravenna, O.
- Carroll Foundry & Machine Co., Bucyrus, O.
- Davenport Locomotive Works, Davenport, Ia.
- Industrial Works, Bay City, Mich. *See page 189*
- Link-Belt Co., Chicago, Ill. *See page 178*
- McMyler Interstate Co., Bedford, O.
- Ohio Locomotive Crane Co., Southern Ave., Bucyrus, O.
- *Orton & Steinbrenner Co., 608 So. Dearborn St., Chicago, Ill.

Mail (Steel)

Columbian Mail Crane Co., Columbus, O.

Pillar

- Currier & Sons, Cyrus, Newark, N. J.
- Industrial Works, Bay City, Mich. *See page 189*
- *Northern Engineering Works, Detroit, Mich.

Pneumatic

- *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
- Stamp Co., Charles E., Cleveland, O.

Portable

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*

Wrecking

Browning Co., Cleveland, O.
Industrial Works, Bay City, Mich. *See page 189*

CRANK PIN TURNING MACHINES (Portable)

Hartford Engine Works, 223 State St., Hartford, Conn.

CRANKSHAFTS

Evansville Gas Engine Works, 1230 Riverside Ave., Evansville, Ill.
Leard, Wm. E., New Brighton, Pa.
Williams & Co., J. H., Brooklyn, N. Y.

CRANKS, BALL

Cincinnati Ball Crank Co., Cincinnati, O. *See page 254*

CRIMPERS

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*

CRUCIBLES, GRAPHITE

McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Seidel, Inc., R. B., 1322 Callowhill St., Philadelphia, Pa.

CRUSHERS**Coal**

- Aero Pulverizer Co., 120 Broadway, New York, N. Y. *See page 68*
- *Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
- *Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.
- *Link-Belt Co., Chicago, Ill. *See page 178*
- *Orton & Steinbrenner Co., 608 So. Dearborn St., Chicago, Ill.
- Pennsylvania Crusher Co., Stephen Girard Bldg., Philadelphia, Pa.
- Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*
- Worthington Pump & Mchy. Corp'n (Power & Mining Mchy. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Hammer

- Chalmers & Williams, Inc., Chicago Heights, Ill.
- Gruendler Patent Crusher & Pulverizer Co., 928 N. First St., St. Louis, Mo.
- Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

Jaw

- Traylor Engineering & Mfg. Co., Allentown, Pa.
- Worthington Pump & Mchy. Corp'n (Power & Mining Mchy. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Laboratory

- American Apparatus Corp'n, 9-11 F. 16th St., New York, N. Y. *See page 334*

Ore and Rock

- Buchanan Co., Inc., C. C., 90 West St., New York, N. Y.
- Chalmers & Williams, Inc., Chicago Heights, Ill.
- Good Roads Machinery Co., Fort Wayne, Ind.
- Johnson Engineering Works, 1734 First Natl. Bank Bldg., Chicago, Ill.
- Sturtevant Mill Co., Harrison Sq., Boston, Mass.

Roll

- American Clay Machinery Co., Bucyrus, O.
- Lehigh Car, Wheel & Axle Works, Catsasauqua, Pa. *See page 69*
- McLanahan-Stone Machine Co., Hollidaysburg, Pa.
- Worthington Pump & Mchy. Corp'n (Power & Mining Mchy. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Wood Pulp

- Carthage Machine Co., Carthage, N. Y.
- CRUSHING AND GRINDING MACHINERY**
- *Fulton Iron Works, St. Louis, Mo. *See page 21*

Cra

Holmes & Blanchard Co., 31 State St., Boston, Mass.

*Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 69*

Pennsylvania Crusher Co., Stephen Girard Bldg., Philadelphia, Pa.

Raymond Bros. Impact Pulverizer Co., 1319 N. Branch St., Chicago, Ill.

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Sturtevant Mill Co., Harrison Sq., Boston, Mass.

Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

Worthington Pump & Mchy. Corp'n (Power & Mining Mchy. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

CRYSTALLIZERS (Sugar)

Turl Iron & Car Co., Inc., 50 Broad St., New York, N. Y.

CRYSTOLON

(See Abrasive Materials)

CUPOLA LIGHTERS

Anthony Co., 138 West Ave., Long Island City, N. Y. *See page 264*

CUPOLAS, FOUNDRY

*Bigelow Co., 76 River St., New Haven, Conn. *See page 40*

Hay's Sons, Sam'l W., 1408-9 Keenan Bldg., Pittsburgh, Pa.

Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*

*Northern Engineering Works, Detroit, Mich.

CUPS, OIL AND GREASE

(See Oil and Grease Cups)

CUT-OUTS, ELECTRIC

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Johns-Pratt Co., 555 Capitol Ave., Hartford, Conn.

CUTTERS

Boiler Tube

Redington Co., F. B., 112-114 So. Sangamon St., Chicago, Ill.

Skinner & Co., M. B., 562 Washington Blvd., Chicago, Ill.

Bolt

Acme Machinery Co., Cleveland, O.

Boynton & Plummer, Inc., Chester Depot, Va.

Brown Co., H. B., East Hampton, Conn.

Landis Machine Co., Waynesboro, Pa.

Webster & Perks Tool Co., Springfield, O.

Williams Tool Co., Erie, Pa.

Coal

Morgan-Gardner Electric Co., Chicago, Ill.

Pneumelectric Machine Co., Syracuse, N. Y.

Gauge Glass

Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*

Gear and Formed

Union Twist Drill Co., Athol, Mass. *See page 245*

Milling

Becker Milling Machine Co., Hyde Park, Boston, Mass.

Brown & Sharpe Mfg. Co., Providence, R. I.

Detroit Twist Drill Co., 634-646 Fort West, Detroit, Mich.

Ingersoll Milling Machine Co., Rockford, Ill.

Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

Lincoln-Williams Twist Drill Co., Taunton, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

Standard Tool Co., Cleveland, O.

Toledo Drill & Tool Co., Toledo, O.

Union Twist Drill Co., Athol, Mass. *See page 245*

Pipe

*Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Nye Tool & Machine Works, 108-128 N. Jefferson St., Chicago, Ill.

Sanders Sons, Inc., D., 21 Atherton St., Yonkers, N. Y.

Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, O.

Sheet Metal

Savage Co., W. J., Knoxville, Tenn.

Veneer (Rotary)

Merritt Mfg. Co., Lockport, N. Y.

CUTTING APPARATUS

Oxy-Acetylene

General Welding & Equipment Co., 107 Massachusetts Ave., Boston, Mass.

Oxy-Hydrogen

General Welding & Equipment Co., 107 Massachusetts Ave., Boston, Mass.

CUTTING MACHINES (Paper, Cloth, Leather, etc.)

Dexter Folder Co., 200 Fifth Ave., New York, N. Y.

Oswego Machine Works, Oswego, N. Y.

CUTTING-OFF MACHINES

Abrasive

Peter Bros. Mfg. Co., Algonquin, Ill.

Slack Mfg. Co., Springfield, Va.

Cold Saw

Cochrane-Bly Co., Rochester, N. Y.

Davenport Machine Tool Co., New Bedford, Mass.

Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Earle Gear & Machine Co., Philadelphia, Pa.

Espen-Lucas Machine Works, Front St. & Girard Ave., Philadelphia, Pa.

Matson Machine Co., Concord, N. H.

Mummert-Dixon Co., Hanover, Pa.

Newton Machine Tool Works, Inc., 23rd & Vine Sts., Philadelphia, Pa.

Nutter & Barnes Co., Hinsdale, N. H.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

CYCLOMETERS

*Veeder Mfg. Co., Hartford, Conn. *See page 341*

CYLINDERS, PUMP

McDonald Mfg. Co., A. Y., Dubuque, Ia.

CYLINDERS, REBORED

Hartford Engine Works, 223 State St., Hartford, Conn.

Wendland Engrg. & Const. Co., C. F., 63 Wooster St., New York, N. Y.

D

DAIRY MACHINERY

Rice & Adams Corp'n, Buffalo, N. Y.

DAMPER REGULATORS

(See Regulators, Damper)

DAMPING DEVICES (Pressure Gauge)

Loomis, O. P., Newport News, Va.

DEHUMIDIFYING APPARATUS

Carrier Engineering Corp'n, 39 Cortlandt St., New York, N. Y.

DERRICKS AND DERRICK FITTINGS

American Hoist & Derrick Co., St. Paul, Minn.

Byers Machine Co., John F., Ravenna, O.

See Catalogue Section for data of firms listed in bold face type

DERRICKS AND DERRICK FITTINGS
(continued)

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
 *Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
 Parker, S. E., 1800 N. Francisco Ave., Chicago, Ill.
 Superior Iron Works Co., Superior, Wis.
 Whitehead & Kales Iron Works, Beecher Ave. & M. C. R. R., Detroit, Mich.

DESTRUCTORS, REFUSE

- Kewanee Boiler Co., Kewanee, Ill.
 Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

DIE CASTINGS

(See Castings, Die Molded)

DIE CUTTING

- Hoggson & Pettis Mfg. Co., New Haven, Conn. *See pages 250, 251, 252*
 Noble & Westbrook Mfg. Co., Hartford, Conn. *See page 241*

DIE CUTTING MACHINERY

- Keller Mechanical Engraving Co., 70 Washington St., Brooklyn, N. Y.

DIE SINKING MACHINES

- Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*
 Pratt & Whitney Co., Hartford, Conn.

DIE STOCKS

(See Stocks and Dies)

DIES**Blanking**

- McCall Machine Works, Rochester, N. Y.
 Meriden Press & Drop Co., 153 State St., Meriden, Conn.

Cutting (Paper, Cloth and Rubber)

- Hoggson & Pettis Mfg. Co., New Haven, Conn. *See pages 250, 251, 252*

Punching

- Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*
 Columbus Die, Tool & Machine Co., Columbus, O.
 Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

Sheet Metal Working

- Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*
 Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.
 Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*
 Robinson Tool Works, Inc., Waterbury, Conn.
 Toledo Machine & Tool Co., Toledo, O.

Stamping

- Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*
 Keller Mechanical Engraving Co., 70 Washington St., Brooklyn, N. Y.
 Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*
 Owen & Co., E. H., 101-109 N. Jefferson St., Chicago, Ill.

Sub-Press

- Mehl Machine, Tool & Die Co., Roselle, N. J. *See pages 238, 239*
 Sheffield Machine & Tool Co., Dayton, O.
 Waltham Machine Works, 296 Newton St., Waltham, Mass.

Thread Cutting

- Conant & Donelson Co., Conway, Mass.
 Ideal Tool & Mfg. Co., Beaver Falls, Pa.
 *Jones & Lamson Machine Co., Springfield, Vt. *See pages 220, 221, 222, 223*
 Landis Machine Co., Waynesboro, Pa.
 Modern Tool Co., Erie, Pa. *See page 244*

National-Acme Mfg. Co., Cleveland, O. *See pages 226, 227*

Nye Tool & Machine Works, 108-128 N. Jefferson St., Chicago, Ill.

Thread Cutting (Self Opening)

- Eastern Machine Screw Corp., New Haven, Conn.
 Errington Mechanical Laboratory, 41 Cortlandt St., New York, N. Y.
 Geometric Tool Co., New Haven, Conn.
 *Greenfield Tap and Die Corp'n, Greenfield, Mass.
 Ideal Tool & Mfg. Co., Beaver Falls, Pa.
 *Jones & Lamson Machine Co., Springfield, Vt. *See pages 220, 221, 222, 223*
 Modern Tool Co., Erie, Pa. *See page 244*
 National-Acme Mfg. Co., Cleveland, O. *See pages 226, 227*

Thread Rolling

Cleveland Die & Mfg. Co., Cleveland, O.

DIESEL ENGINES

(See Engines, Oil, Diesel)

DIFFERENTIALS, AUTOMOBILE

Warner Gear Co., Muncie, Ind.

DIGESTERS

- *Bigelow Co., 76 River St., New Haven, Conn. *See page 40*
 Manitowoc Boiler Works, Manitowoc, Wis.

Welded

American Welding Co., Carbondale, Pa.

DIGGING MACHINERY

Hayward Co., 50 Church St., New York, N. Y.

DIGGING & RECLAIMING TOWERS (Electric)

Maine Electric Co., 35 Commercial St., Portland, Me.

DISCS, FRICTION (High Speed)

Hunter Saw & Machine Co., 57th & Butler Sts., Pittsburgh, Pa.

DISINTEGRATING MACHINERY

Holmes & Blanchard Co., 31 State St., Boston, Mass.

Stedmans Foundry & Machine Works, Aurora, Ind.

Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago. *See pages 302, 303*

DISTILLING MACHINERY AND APPARATUS

Badger & Sons Co., E. B., 63 Pitt St., Boston, Mass.

Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

Hodges Water Still Co., Pennsylvania Bldg., Philadelphia, Pa.

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

DITCHERS, RAILROAD

American Hoist & Derrick Co., St. Paul, Minn.

Browning Co., Cleveland, O.

DIVING APPARATUS

Morse & Son, Inc., Andrew J., 221 High St., Boston, Mass.

DOOR AND STEP CONTROL

National Pneumatic Co., 50 Church St., New York, N. Y.

DOOR LOCKS, SAFETY (Elevator)

- Bolles Iron & Wire Works, J. E., 53 Porter St., Detroit, Mich.
 Maintenance Co., 417-421 Canal St., New York, N. Y.
 Wheeler-McDowell Elevator Co., 417 Canal St., New York, N. Y.

DOORS**Bulkhead (Hydraulic)**

McNab Co., Bridgeport, Conn.

Chain Screen

Codd Co., F. J., 700-708 S. Caroline St., Baltimore, Md.

Der

Elevator

Bolles Iron & Wire Works, J. E., 53 Porter St., Detroit, Mich.

Fire Proof

Coburn Trolley Track Mfg. Co., Holyoke, Mass.

Richards-Wilcox Mfg. Co., Aurora, Ill.

Van Noorden & Co., E., 100 Magazine St., Boston, Mass.

DOORS AND FRAMES (Furnace)

Knox Pressed & Welded Steel Co., Pittsburgh, Pa.

DOORS AND SHUTTERS**Steel (Fire)**

McLauchlin Co., Geo. T., 120 Fulton St., Boston, Mass.

Merchant & Evans Co., 2019-2035 Washington Ave., Philadelphia, Pa.

Steel, Rolling

Edwards Mfg. Co., 305-336 Eggleston Ave., Cincinnati, O. *See page 269*

Wilson Corp'n, J. G., Norfolk, Va.

DOWELS, HICKORY

Minton & Son, T. W., Barboursville, Ky.

DRAFT GEARS

Symington Co., T. H., 30 Church St., New York, N. Y.

DRAFT, MECHANICAL

(See Mechanical Draft Apparatus)

DRAG LINE EXCAVATORS

(See Excavating Machinery)

DREDGES, DRY LAND

Wickes Bros., 512 Water St., Saginaw, Mich.

DREDGING MACHINERY

Bucyrus Co., South Milwaukee, Wis.

Flory Mfg. Co., S., Bangor, Pa.

Hayward Co., 50 Church St., New York, N. Y.

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

*Morris Machine Works, Baldwinsville, N. Y. *See pages 288, 289*

Osgood Co., Marlon, O.

Superior Iron Works Co., Superior, Wis.

DRILL HEADS

Hoefler Mfg. Co., Freeport, Ill.

Sellew Machine Tool Co., 28 Bayley St., Pawtucket, R. I.

DRILL SHARPENERS

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Shaw Pneumatic Tool Co., C. H., 35th & Wazee Sts., Denver, Colo.

DRILL SOCKETS AND SLEEVES

American Specialty Co., 29 East Madison St., Chicago, Ill.

Cleveland Twist Drill Co., Cleveland, O.

DRILLING ATTACHMENTS (High Speed)

Graham Mfg. Co., Providence, R. I.

DRILLING CABLES

American Mfg. Co., Noble & West Sts., Brooklyn, N. Y.

Columbian Rope Co., Auburn, N. Y.

Waterbury Co., 63 Park Row, New York, N. Y.

DRILLING MACHINES**Gun Barrel**

Pratt & Whitney Co., Hartford, Conn.

Heavy Duty

Baker Bros., Toledo, O.

Coburn Machine Tool Co., Franklin, Pa.

Western Machine Tool Works, Holland, Mich.

Horizontal

National Automatic Tool Co., Richmond, Ind.

Rockford Drilling Machine Co., Ft. of Catherine St., Rockford, Ill.

Universal Boring Machine Co., 30 Tower St., Hudson, Mass.

Multiple Spindle

Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill.

Bauch Machine Tool Co., Springfield, Mass.

Cincinnati Bickford Tool Co., Cincinnati, O.

Cincinnati Pulley Machinery Co., Cincinnati, O.

Coburn Machine Tool Co., Franklin, Pa.

Harrington, Son & Co., Inc., Edwin, 17th & Callowhill Sts., Philadelphia, Pa.

Henry & Wright Mfg. Co., 760 Windsor St., Hartford, Conn.

Hoefler Mfg. Co., Freeport, Ill.

Michigan Press Co., Ypsilanti, Mich.

Moline Tool Co., 319-20th St., Moline, Ill.

National Automatic Tool Co., Richmond, Ind.

Pratt & Whitney Co., Hartford, Conn.

Quint Turret Drill Works, 8 Clinton St., Hartford, Conn.

Reed Co., Francis, Worcester, Mass.

Reed-Prentice Co., Worcester, Mass. *See page 224*

Sipp Machine Co., Paterson, N. J. *See page 234*

Valley City Machine Works, 12-16 Campau Ave., Grand Rapids, Mich.

Radial

American Tool Works Co., Cincinnati, O.

Carlton Machine Tool Co., 1543 Queen City Ave., Cincinnati, O.

Cincinnati Bickford Tool Co., Cincinnati, O.

Dresses Machine Tool Co., 225-239 W. McMicken Ave., Cincinnati, O.

Fosdick Machine Tool Co., Blue Rock & Apple St., Cincinnati, O.

Henry & Wright Mfg. Co., 760 Windsor St., Hartford, Conn.

Morris Machine Tool Co., Court & Harriet Sts., Cincinnati, O.

Mueller Machine Tool Co., Cincinnati, O.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Reed-Prentice Co., Worcester, Mass. *See page 224*

Western Machine Tool Works, Holland, Mich.

Sensitive

Burke Machine Tool Co., Conneaut, O.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Carlton Machine Tool Co., 1543 Queen City Ave., Cincinnati, O.

Cincinnati Pulley Machinery Co., Cincinnati, O.

Henry & Wright Mfg. Co., 760 Windsor St., Hartford, Conn.

Reed Co., Francis, Worcester, Mass.

Reed-Prentice Co., Worcester, Mass. *See page 224*

*Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*

Sibley Machine Co., 206 East Tutt St., South Bend, Ind.

Sipp Machine Co., Paterson, N. J. *See page 234*

Standard Mfg. Co., Bridgeport, Conn.

Superior Machine Tool Co., Kokomo, Ind.

Taylor & Fenn Co., Hartford, Conn.

Vertical

Aurora Tool Works, Aurora, Ind.

Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill.

Boynnton & Plummer, Inc., Chester Depot, Va.

Cincinnati Bickford Tool Co., Cincinnati, O.

Coates Cliffin Mfg. Co., Worcester, Mass.

Corbin-Church Co., New Britain, Conn.

Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Detroit Tool Co., Detroit, Mich.

Hoefler Mfg. Co., Freeport, Ill.

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See Catalogue Section for data of firms listed in bold face type

DRILLING MACHINES (continued)**Vertical**

- Leland Gifford Co., Worcester, Mass.
 Myers Machine Tool Co., Columbia, Pa.
 Reed-Prentice Co., Worcester, Mass. *See page 224*
 Robertson Machine & Foundry Co., W. 58 Rano St., Buffalo, N. Y.
 Rockford Drilling Machine Co., Ft. of Catherine St., Rockford, Ill.
 *Ryersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*
 Sibley Machine Co., 206 East Tutt St., South Bend, Ind.
 Sigourney Tool Co., 9 Sigourney St., Hartford, Conn.
 Silver Mfg. Co., Salem, O.
 Simplex Machine Tool Co., Hamilton, O.
 Sipp Machine Co., Paterson, N. J. *See page 234*
 Superior Machine Tool Co., Kokomo, Ind.

DRILLS**Core**

- Standard Diamond Drill Co., First Natl. Bank Bldg., Chicago, Ill.

Diamond

- Standard Diamond Drill Co., First Natl. Bank Bldg., Chicago, Ill.
 Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

Percussion (Hand Operated)

- Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*

Pneumatic

- Cleveland Pneumatic Tool Co., 6410 Hawthorne Ave., Cleveland, O.
 Helwig Mfg. Co., St. Paul, Minn.
 Independent Pneumatic Tool Co., 1307 Michigan Ave., Chicago, Ill.
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 Shaw Pneumatic Tool Co., C. H., 35th & Wazee Sts., Denver, Colo.

Portable (Electric)

- American Electric Tool Co., West Newton, Mass.
 Black & Decker Mfg. Co., 105-15 S. Calvert St., Baltimore, Md.
 Clark, Jr., Electric Co., Jas., Louisville, Ky.
 Electro Magnetic Tool Co., 2902 Canoll Ave., Chicago, Ill.
 Fortuna Machine Co., 127 Duane St., New York, N. Y.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Hisey-Wolf Machine Co., Colerain & Marshall, Cincinnati, O.
 Neil & Smith Electric Tool Co., 120-2 E. 6th St., Cincinnati, O.
 Standard Electric Tool Co., Cincinnati, O.
 Star Expansion Bolt Co., 147-149 Cedar St., New York, N. Y.
 Van Dorn Electric Tool Co., Cleveland, O. *See page 141*

Post (Blacksmiths')

- Noyes & Co., B. B., Greenfield, Mass.

Rock

- *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 Shaw Pneumatic Tool Co., C. H., 35th & Wazee Sts., Denver, Colo.
 Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.

Square Hole

- Lawson & Co., Inc., 90 West St., New York, N. Y.

Stone

- Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*
 Star Expansion Bolt Co., 147-149 Cedar St., New York, N. Y.

Twist

- Celfor Tool Co., Buchanan, Mich.
 Cleveland Twist Drill Co., Cleveland, O.
 Detroit Tool Co., Detroit, Mich.
 Detroit Twist Drill Co., 634-646 Fort West, Detroit, Mich.
 Lincoln-Williams Twist Drill Co., Taunton, Mass.
 Morse Twist Drill & Machine Co., New Bedford, Mass.
 National Twist Drill & Tool Co., Detroit, Mich.
 New Process Twist Drill Co., Taunton, Mass.
 Standard Tool Co., Cleveland, O.
 Syracuse Twist Drill Co., Syracuse, N. Y.
 Toledo Drill & Tool Co., Toledo, O.
 Union Twist Drill Co., Athol, Mass. *See page 245*
 Whitman & Barnes Mfg. Co., Akron, O.

Well

- Keystone Driller Co., Beaver Falls, Pa.

DROP FORGINGS, HAMMERS, PRESSES, ETC.

- (See Forgings, Hammers, Presses, etc., Drop)

DROPS, PNEUMATIC

- Miles Co., George, Winsted, Conn.

DRY BLAST PLANTS

- Carrier Engineering Corp'n, 39 Cortlandt St., New York, N. Y.

DRY KILNS

- (See Kilns, Dry)

DRYERS**Fruit**

- Fahrney, E. B., Waynesboro, Pa.

Lumber and Veneer

- Merritt Mfg. Co., Lockport, N. Y.
 Miller Safe Co., Baltimore, Md.

Rotary

- American Clay Machinery Co., Bucyrus, O.
 American Process Co., 68 William St., New York, N. Y.
 *Bigelow Co., 76 River St., New Haven, Conn. *See page 40*
 Cummer & Son Co., F. D., 413 The Arcade, Cleveland, O.
 Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
 Grupe Drier & Boiler Co., 325-331 E. Second St., Davenport, Ia.
 Hersey Mfg. Co., South Boston, Mass.
 Lehigh Car, Wheel & Axle Works, Catsauqua, Pa. *See page 69*
 Manitowoc Boiler Works, Manitowoc, Wis.
 Mashek Engineering Co., 90 West St., New York, N. Y.
 Ruggles-Coles Engineering Co., York, Pa.
 Union Engineering Co., 1616 Columbus Rd., Cleveland, O.
 Wheeler Condenser & Engineering Co., Carteret, N. J.

Vacuum

- Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.
 Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
 Hubbard's Sons, Norman, 265 Water St., Brooklyn, N. Y.
 Koven & Brother, L. O., Jersey City, N. J. *See page 301*
 Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Varnish

- Greeff Engineering & Mfg. Co., 36 Spring St., Newark, N. J.

DRYING APPARATUS

- American Blower Co., Detroit, Mich. *See pages 280, 281*

Dri

- Carrier Engineering Corp'n, 39 Cortlandt St., New York, N. Y.
 Cutter, Geo. A., Taunton, Mass.
 Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
Koven & Brother, L. O., Jersey City, N. J. *See page 301*
 New York Blower Co., East Orange, N. J.
Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. *See page 297*
 Ruggles-Coles Engineering Co., York, Pa.
 Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*
- DUCTS, AIR (Canvas)**
 Bemis Bro. Bag Co., St. Louis, Mo.
- DUMBWAITERS**
 Bates Elevator Co., Baltimore, Md.
 McLauthlin Co., Geo. T., 120 Fulton St., Boston, Mass.
 Reedy Co., H. J., Cincinnati, O.
 Sedgwick Machine Works, Inc., 128 W. Liberty St., New York, N. Y.
 Storm Mfg. Co., 50 Vesey St., Newark, N. J.
- Electric**
 General Elevator Co., 29 Broadway, New York, N. Y.
 Roberts Elevator Co., James H., 430 W. Broadway, New York, N. Y.
 Storm Mfg. Co., 60 Vesey St., Newark, N. J.
- Hydraulic Plunger**
 Standard Plunger Elevator Co., 243 Stafford St., Worcester, Mass.
- DUMP CARS**
 (See Cars, Dump)
- DUST COLLECTORS**
 Allington & Curtis Mfg. Co., 402 Holden St., Saginaw, Mich.
American Blower Co., Detroit, Mich. *See pages 280, 281*
 Cyclone Blow Pipe Co., 2552 W. 21st St., Chicago, Ill.
 Dixie Mfg. Co., Inc., Baltimore, Md.
 Knickerbocker Co., Jackson, Mich.
 Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.
 Pangborn Corp'n, Hagerstown, Md.
 Sterling Blower Co., Hartford, Conn.
- Metal**
 Clark Dust Collecting Co., 1116 Fisher Bldg., Chicago, Ill.
- Cloth**
 Clark Dust Collecting Co., 1116 Fisher Bldg., Chicago, Ill.
- DUST AND SMOKE DETERMINATORS**
 Sargent Steam Meter Co., 1902 N. California Ave., Chicago, Ill.
- DUSTING MACHINERY**
 Jones & Sons Co., E. D., 25 Depot St., Pittsfield, Mass.
- DUSTPROOFING MATERIALS**
 *Sonneborn Sons, Inc., L., 262 Pearl St., New York, N. Y.
- DYEING MACHINERY**
 Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. *See page 297*
- DYNAMOMETERS**
 Chaitillon & Sons, John, 85-93 Cliff St., New York, N. Y. *See page 315*
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 320*
 Standard Motor Construction Co., 172-190 Whiton St., Jersey City, N. J.
- E**
- ECONOMIZERS, FUEL**
 Green Fuel Economizer Co., 90 West St., New York, N. Y. *See page 58*

- Sturtevant Co., B. F., Hyde Park, Boston, Mass.
- EJECTORS**
American Injector Co., Detroit, Mich. *See page 116*
 Beggs & Co., James, 36 Warren St., New York, N. Y.
Penberthy Injector Co., Detroit, Mich. *See page 117*
 Trauter Mfg. Co., Pittsburgh, Pa.
 Watson, N. A., 2016 State St., Erie, Pa.
 Watson & McDaniel Co., 146 N. Seventh St., Philadelphia, Pa.
 Weber Subterranean Pump Co., 90 West St., New York, N. Y.
- Ash (Hydraulic)**
 Great Lakes Engineering Works, Detroit, Mich.
 McNab Co., Bridgeport, Conn.
- Ash (Suction)**
 Girtanner-Daviess Eng. & Contg. Co., 504 Chemical Bldg., St. Louis, Mo.
 *Green Engineering Co., East Chicago, Ind. *See pages 64, 65*
 Griffin Engineering & Construction Co., Elkhart, Ind.
- Sewage (Centrifugal)**
 Chicago Pump Co., 904-10 W. Lake St., Chicago, Ill.
 Economy Pumping Machinery Co., 116-118 N. Carpenter St., Chicago, Ill.
 Kerr Machinery & Supply Co., Kerr Bldg., Detroit, Mich.
 Yeomans Bros. Co., 231 Institute Place, Chicago, Ill.
- Sewage (Pneumatic)**
 Yeomans Bros. Co., 231 Institute Place, Chicago, Ill.
- ELBOWS, UNION**
 Bard Union Co., Inc., Norwich, Conn.
- ELECTRIC FURNACES, GENERATORS, HOISTS, TRUCKS, WELDING, ETC.** **Ele**
 (See Furnaces, Generators, Hoists, Trucks, Welding, etc., Electric)
- ELECTRICAL MACHINERY**
 *Crocker, Wheeler Co., Ampere, N. J. *See page 32*
 Diehl Mfg. Co., Elizabethport, N. J.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
- ELECTRICAL MEASURING INSTRUMENTS**
 (See Instruments, Electrical Measuring)
- ELECTRICAL SUPPLIES**
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Harvey Hubbell, Inc., State St. & Bostwick Ave., Bridgeport, Conn.
 *Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
- ELECTRICAL TESTING APPARATUS**
 Leeds & Northrup Co., Philadelphia, Pa.
- ELECTRODES**
 Acheson Graphite Co., Niagara Falls, N. Y.
- ELEVATING AND CONVEYING MACHINERY**
 Alvey-Ferguson Co., Cincinnati, O.
 American Machinery & Construction Co., Milwaukee, Wis.
 Bartlett & Snow Co., C. O., Cleveland, O.
 Brown Portable Elevator Co., Chicago, Ill. *See page 179*
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 *Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*
 Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

See Catalogue Section for data of firms listed in bold face type

ELEVATING AND CONVEYING MACHINERY
(continued)

- Ehram & Sons Mfg. Co., J. B., Enterprise, Kan.
 *Hill Clutch Co., Cleveland, O. *See page 148*
 *Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.
 *Link-Belt Co., Chicago, Ill. *See page 178*
 Meese & Gottfried Co., San Francisco, Cal.
 Mey Chain Belt Co., 82 Washington St., Buffalo, N. Y.
 Moore & Lorenz Co., 2144-52 W. Fulton St., Chicago, Ill.
 N. Y. Revolving Portable Elevator Co., 343-351 Garfield Ave., Jersey City, N. J. *See page 183*
 Robins Conveying Belt Co., Park Row Bldg., New York, N. Y.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*
 Union Engineering Co., 1616 Columbus Rd., Cleveland, O.
 United Iron Works Co., Iola, Kan.

ELEVATING TRUCKS

(See Trucks, Elevating)

ELEVATOR APPLIANCES

- Maintenance Co., 417-421 Canal St., New York, N. Y.
 Wheeler-McDowell Elevator Co., 417 Canal St., New York, N. Y.

ELEVATOR CABS AND ENCLOSURES

- Ohio Elevator & Machine Co., Columbus, O.
 Smith-Rhea Co., Baltimore, Md.

ELEVATOR GUIDES, COLD DRAWN

- *Union Drawn Steel Co., Beaver Falls, Pa. *See page 208*

ELEVATORS**Electric**

- Albro-Clem Elevator Co., 7th St. & Glenwood Ave., Philadelphia, Pa.
 American Electric Machine & Elevator Co., 1706 N. 12th St., St. Louis, Mo.
 American Elevator & Machine Co., Louisville, Ky.
 Bates Elevator Co., Baltimore, Md.
 Haughton Elevator & Machine Co., Toledo, O.
 Houser Elevator Co., 314 E. Water St., Syracuse, N. Y.
 Reedy Co., H. J., Cincinnati, O.
 Roberts Elevator Co., James H., 430 W. Broadway, New York, N. Y.
 Sidney Elevator Mfg. Co., Sidney, O.
 Warner Elevator Mfg. Co., Cincinnati, O.
 Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*

Hand Power

- Sedgwick Machine Works, Inc., 128 W. Liberty St., New York, N. Y.
 Sidney Elevator Mfg. Co., Sidney, O.

Hydraulic

- Haughton Elevator & Machine Co., Toledo, O.
 Reedy Co., H. J., Cincinnati, O.

Hydraulic Plunger

- Standard Plunger Elevator Co., 243 Stafford St., Worcester, Mass.
 Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*

Inclined

(See Carriers and Elevators, Freight)

Passenger and Freight

- Albro-Clem Elevator Co., 7th St. & Glenwood Ave., Philadelphia, Pa.
 American Elevator & Machine Co., Louisville, Ky.
 Baker Iron Works, 950 N. Broadway, Los Angeles, Cal.
 Bates Elevator Co., Baltimore, Md.
 Eastern Machinery Co., New Haven, Conn.
 General Elevator Co., 29 Broadway, New York, N. Y.
 Haughton Elevator & Machine Co., Toledo, O.

- Houser Elevator Co., 314 E. Water St., Syracuse, N. Y.
 Kimball Bros Co., Council Bluffs, Ia.
 Maintenance Co., 417-421 Canal St., New York, N. Y.
 Mason & Co., Inc., Volney W., 2 Lafayette St., Providence, R. I.
 McLauthlin Co., Geo. T., 120 Fulton St., Boston, Mass.
 Ohio Elevator & Machine Co., Columbus, O.
 Otis Elevator Co., 11th Ave. & 26th St., New York, N. Y.
 Park Mfg. Co., Charlotte, N. C.
 Reedy Co., H. J., Cincinnati, O.
 Ridgway & Son Co., Craig, Coatesville, Pa.
 Ruger Mfg. Co., J. W., 222 Chicago St., Buffalo, N. Y.
 Sidney Elevator Mfg. Co., Sidney, O.
 Smith-Rhea Co., Baltimore, Md.
 Speidel, J. G., Reading, Pa.
 Standard Plunger Elevator Co., 243 Stafford St., Worcester, Mass.
 Storm Mfg. Co., 50 Vesey St., Newark, N. J.
 Warner Elevator Mfg. Co., Cincinnati, O.
 Westbrook Elevator Co., Inc., Danville, Va.
 Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*
 Wheeler-McDowell Elevator Co., 417 Canal St., New York, N. Y.

Portable

- Brown Portable Elevator Co., Chicago, Ill. *See page 179*
 Economy Engineering Co., 415 S. Washtenaw Ave., Chicago, Ill.
 N. Y. Revolving Portable Elevator Co., 343-351 Garfield Ave., Jersey City, N. J. *See page 183*

Steam-hydraulic

- Ridgway & Son Co., Craig, Coatesville, Pa.

Telescopic

- American Machinery & Construction Co., Milwaukee, Wis.

Traction

- Reedy Co., H. J., Cincinnati, O.
 Warner Elevator Mfg. Co., Cincinnati, O.
 Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*

EMERY WHEELS

(See Grinding Wheels)

ENAMELING MACHINERY (For Wire)

- American Insulating Machinery Co., Inc., Fairhall & Huntingdon Sts., Philadelphia, Pa.

ENCLOSURES, TOOL ROOM

- Fiske Iron Works, J. W., 78-80 Park Place, New York, N. Y.

ENGINE STOPS

- Falls Machine Co., Sheboygan Falls, Wis.
 Falls Motors Corp'n, Sheboygan Falls, Wis.
 Locke Regulator Co., Salem, Mass.
 Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
 Strong, Carlisle & Hammond Co., 328-344 Frankfort Ave., N. W., Cleveland, O.

ENGINEERS' SUPPLIES

- Chesterton Co., A. W., 64 India St., Boston, Mass.
 Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

ENGINES, ALCOHOL

- Cook Motor Co., Delaware, O.

ENGINES, BLOWING

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 *Hooven, Owens, Rentschler Co., Hamilton, O.
 Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
 *Weimer Machine Works Co., Lebanon, Pa.
 Worthington Pump & Mch. Corp'n (Laidlaw Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Ele

ENGINES, DISTILLATE

Doak Gas Engine Co., 4th & Madison Sts., Oakland, Cal.

ENGINES, GAS

- Alberger Gas Engine Co., 285 Chicago St., Buffalo, N. Y.
 Bessemer Gas Engine Co., Grove City, Pa.
 Bruce-Macheth Engine Co., Cleveland, O.
 Buckeye Engine Co., Salem, O.
 Cooper Co., C. & G., Mt. Vernon, O.
 Davis Mfg. Co., 57th Ave. & Mitchell St., Milwaukee, Wis.
 *De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*
 Foos Gas Engine Co., Springfield, O.
 *Hooven, Owens, Rentschler Co., Hamilton, O.
 Hope Engineering & Supply Co., Pittsburgh, Pa.
 Lazier Gas Engine Co., 190 Main St., Buffalo, N. Y.
 *Mesta Machine Co., Pittsburgh, Pa.
 Middletown Machine Co., Middletown, O.
 Miller Improved Gas Engine Co., Springfield, O.
 National Meter Co., 84-86 Chambers St., New York, N. Y. *See pages 28, 316*
 New Way Motor Co., Lansing, Mich.
 *Otto Gas Engine Works, Philadelphia, Pa.
 Page Engineering Co., Foot Latrobe Park, Baltimore, Md.
 Rathbun-Jones Engineering Co., Toledo, O.
 Reeves-Cubberley Engine Co., Trenton, N. J.
 Reid Gas Engine Co., Joseph, Oil City, Pa.
 Rollins Engine Co., Nashua, N. H.
 Standard Gas Engine Co., 1 California St., San Francisco, Cal.
 Steiner & Co., M., 242 S. Torrence St., Dayton, O.
 Weber Engine Co., Kansas City, Mo.
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
 Wisconsin Engine Co., Corliss, Wis.
 Witte Engine Works, Kansas City, Mo.
 Worthington Pump & Mch'y. Corp'n (Snow Plant), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Natural

Rathbun-Jones Engineering Co., Toledo, O.

Producer

Rathbun-Jones Engineering Co., Toledo, O.

ENGINES, GASOLINE

- Angola Gas Engine Co., Angola, Ind.
 Armstrong Mfg. Co., Waterloo, Ia.
 Automatic Machine Co., Bridgeport, Conn.
 Backus Water Motor Co., Newark, N. J.
 Basle-Adams Engineering Co., 14-16 Cambria St., Boston, Mass.
 Benninghofen & Sons, C., Hamilton, O.
 Brownwall Engine & Pulley Co., Holland, Mich.
 Buckeye Mfg. Co., Anderson, Ind.
 Burlingame, S. F., Worcester, Mass.
 Charter Gas Engine Co., Sterling, Ill.
 Christensen Engineering Co., 841 30th St., Milwaukee, Wis.
 Clay Engine Co., 6950 Kinsman Rd., Cleveland, O.
 Cook Motor Co., Delaware, O.
 Davis Mfg. Co., 57th Ave. & Mitchell St., Milwaukee, Wis.
 Dice Machine Co., Anderson, Ind.
 Dissinger & Bro., Inc., C. H. A., Wrightsville, Pa.
 Doak Gas Engine Co., 4th & Madison Sts., Oakland, Cal.
 Domestic Engine & Pump Co., Shippensburg, Pa.
 DuBois Iron Works, DuBois, Pa.
 Ferro Machine & Foundry Co., Cleveland, O.
 Fuller & Johnson Mfg. Co., Madison, Wis.
 Fulton Mfg. Co., Erie, Pa.
 Gade Bros. Mfg. Co., Iowa Falls, Ia.

- Gas Engine & Power Co., and Charles L. Seabury & Co., Consolidated, Morris Heights, New York, N. Y.
 Gibbs Gas Engine Co. of Florida, 26 S. Main St., Jacksonville, Fla.
 Heer Engine Co., Portsmouth, O.
 Hercules Motor Mfg. Co., Canton, O.
 Hettinger Engine Co., Bridgeton, N. J.
 Ideal Engine Co., Lansing, Mich.
 Jacobson Machine Mfg. Co., Warren, Pa.
 Lamb Engine Co., Clinton, Ia.
 McLaughlin Mfg. Co., Geo. G., 24 Washington St., North, Boston, Mass.
 Mietz Machine Works, August, 123 Mott St., New York, N. Y. *See page 27*
 National Meter Co., 84-86 Chambers St., New York, N. Y. *See pages 28, 316*
 National Transit Pump & Machine Co., Oil City, Pa.
 New Way Motor Co., Lansing, Mich.
 Nilson-Miller Co., 1300 Hudson St., Hoboken, N. J.
 Novo Engine Co., Lansing, Mich.
 Ottumwa-Moline Engine & Pump Co., 802-822 Madison Ave., Ottumwa, Ia.
 Portsmouth Engine Co., Portsmouth, O.
 Regal Gasoline Engine Co., Coldwater, Mich.
 Reliance Engineering Co., Lansing, Mich.
 Ruger Mfg. Co., J. W., 222 Chicago St., Buffalo, N. Y.
 Schenck Mfg. & Supply Co., Parkers Landing, Pa.
 Standard Motor Construction Co., 172-180 Whiton St., Jersey City, N. J.
 Steiner & Co., M., 242 S. Torrence St., Dayton, O.
 Stickney Co., Chas. A., St. Paul, Minn.
 Superior Gas Engine Co., Springfield, O.
 Termaat & Monahan Co., Oshkosh, Wis.
 United Engine Co., Lansing, Mich.
 West Chester Engine Co., West Chester, Pa.
 White-Blakeslee Mfg. Co., Birmingham, Ala.
 Witte Engine Works, Kansas City, Mo.
 Worthington Pump & Mch'y. Corp'n (International Gas Engine Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Eng**ENGINES, HOISTING**

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 American Hoist & Derrick Co., St. Paul, Minn.
 Byers Machine Co., John F., Ravenna, O.
 Chase Machine Co., 2313 Elm St., N. W., Cleveland, O.
 *Clyde Iron Works, 29th Ave. West, & Michigan St., Duluth, Minn. *See page 190*
 Crawford & McCrimmon Co., Brazil, Ind.
 Flory Mfg. Co., S., Bangor, Pa.
 Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*
 Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.
 Holmes & Bros., Rob't, Danville, Ill.
 *Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
 *Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
 Litchfield Foundry & Machine Co., Litchfield, Ill.
 Minneapolis Steel & Machinery Co., Minneapolis, Minn.
 *Morris Machine Works, Baldwinville, N. Y. *See pages 288, 289*
 Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
 Ottumwa Iron Works, Ottumwa, Ia.
 Thomas Elevator Co., 20 S. Hoyne Ave., Chicago, Ill.
 Vulcan Iron Works, Wilkes-Barre, Pa.

Geared

Holmes & Bros., Rob't, Danville, Ill.

ENGINES, KEROSENE

- Anderson Engine Co., 3046 N. Rockwell St., Chicago, Ill.
 Benninghofen & Sons, C., Hamilton, O.
 Burlingame, S. F., Worcester, Mass.

See Catalogue Section for data of firms listed in bold face type

ENGINES, KEROSENE (continued)

Charter Gas Engine Co., Sterling, Ill.
 Fuller & Johnson Mfg. Co., Madison, Wis.
 Lanson Mfg. Co., John, New Halstein, Wis.
 Middletown Machine Co., Middletown, O.
 Termaat & Monohan Co., Oshkosh, Wis.
 West Chester Engine Co., West Chester, Pa.
 White-Blakeslee Mfg. Co., Birmingham, Ala.

ENGINES, MARINE

American Engine Co., Detroit, Mich.
 Anderson Engine Co., 4036 N. Rockwell St., Chicago, Ill.
 Atlantic Works, 80 Border St., East Boston, Mass.
 Bath Iron Works, Ltd., Bath, Me.
 Bolinders Co., 30 Church St., New York, N. Y.
 Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Mo. *See page 20*
 Clay Engine Co., 6950 Kinsman Rd., Cleveland, O.
 Craig Engine & Machine Works, James, 807-841 Garfield Ave., Jersey City, N. J.
 Evansville Gas Engine Works, 1230 Riverside Ave., Evansville, Ill.
 Ferro Machine & Foundry Co., Cleveland, O.
 Foy & Bowen Engine Co., Geneva, N. Y.
 *Fulton Iron Works, St. Louis, Mo. *See page 21*

Fulton Mfg. Co., Erie, Pa.
 Gibbs Gas Engine Co. of Florida, 26 S. Main St., Jacksonville, Fla.
 Great Lakes Engineering Works, Detroit, Mich.

Hettinger Engine Co., Bridgeton, N. J.
 Johnson Machine Co., Carlyle, 52 Main St., Manchester, Conn.
 Lamb Engine Co., Clinton, Ia.
 Loew-Victor Engine Co., 2259 Oakdale Ave., Chicago, Ill.

McIntosh & Seymour Corp'n, Auburn, N. Y. *See page 22*

Mietz Machine Works, August, 123 Mott St., New York, N. Y. *See page 27*

Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

New London Ship & Engine Co., Groton, Conn. *See page 23*

Page Engineering Co., Foot Latrobe Park, Baltimore, Md.

Rees & Sons Co., James, Pittsburgh, Pa.
 Regal Gasoline Engine Co., Coldwater, Mich.

Roberts Motor Mfg. Co., Sandusky, O.
 Sheffield Car Co., Three Rivers, Mich.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Standard Gas Engine Co., 1 California St., San Francisco, Cal.

Standard Motor Construction Co., 172-180 Whiton St., Jersey City, N. J.

Termaat & Monohan Co., Oshkosh, Wis.
 Universal Motor Co., Oshkosh, Wis.

Ward Engineering Works, Charles, Charleston, W. Va. *See page 56*

Wetherill & Co., Inc., Rob't, Chester, Pa. *See page 19*

ENGINES, NAPHTHA

Cook Motor Co., Delaware, O.

ENGINES, OIL

Bessemer Gas Engine Co., Grove City, Pa.
 Bolinders Co., 30 Church St., New York, N. Y.

Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Mo. *See page 20*

Charter Gas Engine Co., Sterling, Ill.
 Chicago Pneumatic Tool Co., 1010 Fisher Bldg., Chicago, Ill.

Christensen Engineering Co., 841 30th St., Milwaukee, Wis.

Clay Engine Co., 6950 Kinsman Rd., Cleveland, O.

*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*

Dissinger & Bro., Inc., C. H. A., Wrightsville, Pa.

Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

Falk Co., Milwaukee, Wis. *See pages 138, 139*

Falls Machine Co., Sheboygan Falls, Wis.

*Fulton Iron Works, St. Louis, Mo. *See page 21*

Fulton Mfg. Co., Erie, Pa.
 International Harvester Co. of America, Harvester Bldg., Chicago, Ill.

Johnston & Jennings Co., Cleveland, O.
 Lyons Atlas Co., Indianapolis, Ind.

McIntosh & Seymour Corp'n, Auburn, N. Y. *See page 22*

Mietz Machine Works, August, 123 Mott St., New York, N. Y. *See page 27*

Minneapolis Steel & Machinery Co., Minneapolis, Minn.

Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

Muncie Oil Engine Co., Muncie, Ind.
 Nilson-Miller Co., 1300 Hudson St., Hoboken, N. J.

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Power Mfg. Co., Lima, O.
 Price Pump & Engine Co., G. W., 33 Stevenson St., San Francisco, Cal.

St. Marys Oil Engine Co., St. Charles, Mo.
 Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Weber Engine Co., Kansas City, Mo.
 Worthington Pump & Mch'y. Corp'n (International Gas Engine Works, Snow Plant), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Diesel

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Mo. *See page 20*

Craig Engine & Machine Works, James, 807-841 Garfield Ave., Jersey City, N. J.

Doak Gas Engine Co., 4th & Madison Sts., Oakland, Cal.

*Fulton Iron Works, St. Louis, Mo. *See page 21*

Lyons Atlas Co., Indianapolis, Ind.
 McIntosh & Seymour Corp'n, Auburn, N. Y. *See page 22*

National Transit Pump & Machine Co., Oil City, Pa.

New London Ship & Engine Co., Groton, Conn. *See page 23*

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

*Otto Gas Engine Works, Philadelphia, Pa.
 Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Standard Gas Engine Co., 1 California St., San Francisco, Cal.

ENGINES, PUMPING

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

*Hooven, Owens, Rentschler Co., Hamilton, O.
 Humphrey Pump Construction Co., Youngstown, O.

McGowan Co., John H., Cincinnati, O.

*Morris Machine Works, Baldwinsville, N. Y. *See pages 288, 289*

Murray Iron Works Co., Burlington, Ia. *See page 16*

National Transit Pump & Machine Co., Oil City, Pa.

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Platt Iron Works, Dayton, O. *See page 290*

Rider-Ericsson Engine Co., 20 Murray St., New York, N. Y.

Wetherill & Co., Inc., Rob't, Chester, Pa. *See page 19*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Worthington Pump & Mch'y. Corp'n (Holly Mfg. Co., Laidlaw Works, Fred. M. Prescott Works, Snow Plant, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Eng

ENGINES, STEAM

- Ajax Iron Works, Corry, Pa.
American Blower Co., Detroit, Mich. *See pages 280, 281*
American Engine Co., Detroit, Mich.
American Engine & Electric Co., Bound Brook, N. J. *See page 10*
***Ball Engine Co.**, Erie, Pa. *See page 11*
Bass Foundry & Machine Co., Fort Wayne, Ind. *See page 39*
Buckeye Engine Co., Salem, O.
Chandler & Taylor Co., Indianapolis, Ind.
Chuse Engine & Mfg. Co., Mattoon, Ill.
Clark Bros. Co., Olean, N. Y.
Clark Engine & Boiler Co., Kalamazoo, Mich.
***Clyde Iron Works**, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
Cole Mfg. Co., R. D., Newnan, Ga.
Dutton Co., C. H., Kalamazoo, Mich.
Engberg's Electric & Mechanical Works, St. Joseph, Mich.
***Erie City Iron Works**, Erie, Pa. *See page 12*
Erie Engine Works, Erie, Pa.
Fitchburg Steam Engine Co., Fitchburg, Mass. *See page 13*
***Fulton Iron Works**, St. Louis, Mo. *See page 21*
Godfrey-Keeler Co., 70 Warren St., New York, N. Y.
Griscom-Russell Co., 90 West St., New York, N. Y.
Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*
***Harris-Corliss Engine & Machine Co.**, Providence, R. I. *See page 15*
Harrisburg Foundry & Machine Works, Harrisburg, Pa.
Hewes & Phillip Iron Works, Newark, N. J.
Lane & Bodley, Bond Hill, Cincinnati, O.
Lawrence Machine Co., Lawrence, Mass.
Liddell Co., Charlotte, N. C.
Lucey Mfg. Corp'n of Texas, 308 Texas Co. Bldg., Houston, Tex.
McLaughlin Mfg. Co., Geo. G., 24 Washington St., North, Boston, Mass.
Mecklenburg Iron Works, Charlotte, N. C.
***Morris Machine Works**, Baldwinsville, N. Y. *See pages 288, 289*
***Murray Iron Works Co.**, Burlington, Ia. *See page 16*
Nagle Engine & Boiler Works, Erie, Pa.
Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
Orr & Semhower, Inc., Reading, Pa.
Phoenix Iron Works Co., Meadville, Pa. *See page 53*
Reeves-Cubberley Engine Co., Trenton, N. J.
Schofield's Sons Co., J. S., Macon, Ga.
Shepherd Engineering Co., Williamsport, Pa.
Skinner Engine Co., Erie, Pa. *See page 18*
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Tod Co., William S., Phelps St., Youngstown, O.
***Vilter Mfg. Co.**, 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*
Wachs Co., E. H., 1525 Dayton St., Chicago, Ill.
***Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.
Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*

Automatic

- American Blower Co.**, Detroit, Mich. *See pages 280, 281*
American Engine & Electric Co., Bound Brook, N. J. *See page 10*
***Ball Engine Co.**, Erie, Pa. *See page 11*
Chandler & Taylor Co., Indianapolis, Ind.
Enterprise Co., Columbiana, O.
***Erie City Iron Works**, Erie, Pa. *See page 12*
Erie Engine Works, Erie, Pa.
Fitchburg Steam Engine Co., Fitchburg, Mass. *See page 13*
Frost Mfg. Co., Galesburg, Ill.

- Granger Co.**, A. D., 90 West St., New York, N. Y.
Houston, Stanwood & Gamble Co., Cincinnati, O. *See pages 46, 47*
Ide & Sons, A. L., Springfield, Ill.
Murray Iron Works Co., Burlington, Ia. *See page 16*
Peer Mfg. Co., Comstock, Mich.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Rollins Engine Co., Nashua, N. H.
Schofield's Sons Co., J. S., Macon, Ga.
Skinner Engine Co., Erie, Pa. *See page 18*
Troy Engine & Machine Co., Troy, Pa.

Corliss

- Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.
***Ball Engine Co.**, Erie, Pa. *See page 11*
Bass Foundry & Machine Co., Fort Wayne, Ind. *See page 39*
Chuse Engine & Mfg. Co., Mattoon, Ill.
Cooper Co., C. & G., Mt. Vernon, O.
Filer & Stowell Co., Milwaukee, Wis.
Fitchburg Steam Engine Co., Fitchburg, Mass. *See page 13*
Frick Co., Waynesboro, Pa.
***Fulton Iron Works**, St. Louis, Mo. *See page 21*
Granger Co., A. D., 90 West St., New York, N. Y.
Griffith & Wedge Co., Zanesville, O.
Hardie-Tynes Mfg. Co., Birmingham, Ala. *See page 14*
***Harris-Corliss Engine & Machine Co.**, Providence, R. I. *See page 15*
Hewes & Phillip Iron Works, Newark, N. J.
***Hooven, Owens, Rentschler Co.**, Hamilton, O.
***Mesta Machine Co.**, Pittsburgh, Pa.
Murray Iron Works, Co. Burlington, Ia. *See page 16*
Nagle Corliss Engine Works, Erie, Pa.
Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
Rollins Engine Co., Nashua, N. H.
Strait Mfg. Co., H. N., Kansas City, Kan.
***Vilter Mfg. Co.**, 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*
Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*
Wisconsin Engine Co., Corliss, Wis.

High Speed

- American Blower Co.**, Detroit, Mich. *See pages 280, 281*
American Engine & Electric Co., Bound Brook, N. J. *See page 10*
***Ball Engine Co.**, Erie, Pa. *See page 11*
Brownell Co., Dayton, O.
***Erie City Iron Works**, Erie, Pa. *See page 12*
Fitchburg Steam Engine Co., Fitchburg, Mass. *See page 13*
***Fulton Iron Works**, St. Louis, Mo. *See page 21*
Ide & Sons, A. L., Springfield, Ill.
Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
Skinner Engine Co., Erie, Pa. *See page 18*
Troy Engine & Machine Co., Troy, Pa.

Poppett Valve

- ***Erie City Iron Works**, Erie, Pa. *See page 12*
Murray Iron Works Co., Burlington, Ia. *See page 16*
Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Reverse Valve

- Chase Machine Co.**, 2313 Elm St., N. W., Cleveland, O.

Throttling

- Chandler & Taylor Co.**, Indianapolis, Ind.
Frost Mfg. Co., Galesburg, Ill.
Houston, Stanwood & Gamble Co., Cincinnati, O. *See pages 46, 47*
Wachs Co., E. H., 1525 Dayton St., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Eng*See Catalogue Section for data of firms listed in bold face type*

ENGINES, STEAM (continued)**Uniflow**

Ames Iron Works, Oswego, N. Y.
 Chuse Engine & Mfg. Co., Matttoon, Ill.
 Filer & Stowell Co., Milwaukee, Wis.
 Granger Co., A. D., 90 West St., New York, N. Y.

Murray Iron Works Co., Burlington, Ia. *See page 16*

Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*

Skinner Engine Co., Erie, Pa. *See page 18*

ENGINES, STEERING

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Waters Co., Geo. H., Mariners Harbor, N. Y.

ENGINES, SWINGING

Chase Machine Co., 2313 Elm St., N. W., Cleveland, O.

ENGINES, TRACTION

Buffalo Pitts Co., Carolina & Fourth Sts., Buffalo, N. Y.

Holt Mfg. Co., Stockton, Cal.

Litchfield Foundry & Machine Co., Litchfield, Ill.

ENGRAVING MACHINES

Gorton Machine Co., Geo., Racine, Wis.

ESCALATORS

Otis Elevator Co., 11th Ave. & 26th St., New York, N. Y.

EVAPORATORS

Badger & Sons Co., E. B., 63 Pitt St., Boston, Mass.

Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.

Cook Cane Mill & Evaporator Co., 320 No. 2nd St., St. Louis, Mo.

Griscom-Russell Co., 90 West St., New York, N. Y.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Oat & Sons, Joseph, 232 Quarry St., Philadelphia, Pa.

Sanborn Evaporator Co., 50 Broad St., New York, N. Y.

Standard Water Systems Co., Hampton, N. J.

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

Wheeler Condenser & Engineering Co., Carteret, N. J.

Zaremba Co., 707 D. S. Morgan Bldg., Buffalo, N. Y.

Zellweger & Sons, John, 1900 Adelaide Ave., St. Louis, Mo.

Crystallizing

Zaremba Co., 707 D. S. Morgan Bldg., Buffalo, N. Y.

Fruit

Fahrney, E. B., Waynesboro, Pa.

High Density

Zaremba Co., 707 D. S. Morgan Bldg., Buffalo, N. Y.

Multiple Effect

Sanborn Evaporator Co., 50 Broad St., New York, N. Y.

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

Sugar

Murphy Iron Works, John H., 643 Magazine St., New Orleans, La.

EXCAVATING MACHINERY

Bucyrus Co., South Milwaukee, Wis.

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*

Dull Co., Raymond W., 111 W. Washington St., Chicago, Ill.

Hayward Co., 50 Church St., New York, N. Y.

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Marion Steam Shovel Co., Station D, Marion, O.

Osgood Co., Marion, O.

Potter Mfg. Co., 3511 E. Washington St., Indianapolis, Ind.

Union Iron Works, Hoboken, N. J.

United Iron Works Co., Iola, Kan.

Sewer

Hayward Co., 50 Church St., New York, N. Y.

EXHAUST FANS

(See Fans, Exhaust)

EXHAUST HEADS

Burt Mfg. Co., Akron, O.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Direct Separators Co., Syracuse, N. Y.

Gardner Governor Co., Quincy, Ill. *See page 274*

Konold Co., J., 602 Bessemer Bldg., Pittsburgh, Pa.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Sorge, Jr., & Co., A., Monadnock Block, Chicago, Ill.

Taylor Steam Specialty Co., Battle Creek, Mich. *See page 114*

Willcox Engineering Co., Saginaw, Mich. *See page 317*

Williams, Inc., Franklin, 39 Cortlandt St., New York, N. Y.

EXHAUST OUTLETS

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

EXHAUST SYSTEMS

Cyclohe Blow Pipe Co., 2552 W. 21st St., Chicago, Ill.

Sterling Blower Co., Hartford, Conn.

EXHAUSTERS

Allington & Curtis Mfg. Co., 402 Holden St., Saginaw, Mich.

Gas

American Blower Co., Detroit, Mich. *See pages 280, 281*

Connersville Blower Co., Connersville, Ind.

Green Fuel Economizer Co., 90 West St., New York, N. Y. *See page 58*

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

*Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283*

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Wilbraham-Green Blower Co., Pottstown, Pa.

Multi-Stage (Centrifugal)

Spencer Turbine Cleaner Co., Hartford, Conn.

EXPANSION BOLTS, JOINTS, ETC.

(See Bolts, Joints, etc., Expansion)

EXPERIMENTAL WORK

Nestor Mfg. Co., 40 W. 13th St., New York, N. Y.

Nilson-Miller Co., 1300 Hudson St., Hoboken, N. J.

EXTRACTING APPARATUS

Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

Kent, Inc., Robert Sayre, 50 Court St., Brooklyn, N. Y.

Sanborn Evaporator Co., 50 Broad St., New York, N. Y.

EXTRACTORS**Centrifugal**

Tolhurst Machine Works, Troy, N. Y.

Oil and Grease

Andrews, Inc., William, 120 Liberty St., New York, N. Y. *See page 84*

Eng

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Boston Steam Specialty Co., 185 Franklin St., Boston, Mass.
Jacobs & Co., Charles, 258 Franklin St., Boston, Mass.

EXTRUDED METALS

(See Metals, Extruded)

F

FACE-PLATE JAWS (Portable)
Hoggson & Pettis Mfg. Co., New Haven, Conn. *See pages 250, 251, 252*

FACING HEADS
Mummert-Dixon Co., Hanover, Pa.

FACINGS

Clutch

Cork Insert Co., 164 Federal St., Boston, Mass.

Foundry

Asbury Graphite Mills, Asbury, N. Y.
Hill & Griffith Co., Box 540, Birmingham, Ala.
Obermayer Co., S., 2563 W. 18th St., Chicago, Ill.

FANS, EXHAUST

American Blower Co., Detroit, Mich. *See pages 280, 281*

Backus Water Motor Co., Newark, N. J.
Cyclone Blow Pipe Co., 2552 W. 21st St., Chicago, Ill.

Electric Blower Co., 352 Atlantic Ave., Boston, Mass.

Garden City Fan Co., McCormick Bldg., Chicago, Ill.

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Green Fuel Economizer Co., 90 West St., New York, N. Y. *See page 58*

Howard & Morse, 45 Fulton St., New York, N. Y.

Ilg Electric Ventilating Co., 154 Whiting St., Chicago, Ill.

Indiana Fan Co., 40 E. South St., Indianapolis, Ind.

Meadon's Blower & Pipe Works, 23-27 Meserole Ave., Brooklyn, N. Y.

Mechanical Appliance Co., Milwaukee, Wis.

New England Ventilating & Heating Co., 926 Manton Ave., Providence, R. I.

Perkins & Son, Inc., B. F., Holyoke, Mass.

Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. *See page 297*

Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Zellweger & Sons, John, 1900 Adelaide Ave., St. Louis, Mo.

Mine

American Blower Co., Detroit, Mich. *See pages 280, 281*

Crawford & McCrimmon Co., Brazil, Ind.

Ottumwa Iron Works, Ottumwa, Ia.

FEED WATER CIRCULATORS, HEATERS, REGULATORS, ETC.

(See Circulators, Heaters, Regulators, etc., Feed Water)

FEED WATER HEATERS AND PURIFIERS

(See Heaters and Purifiers, Feed Water)

FEEDERS

Boiler (Low Pressure)

Foskett & Bishop Co., New Haven, Conn.

Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

Conveyor Belt

Holmes & Bros., Rob't, Danville, Ill.

Graphite

American Graphite Feeding Device Co., Manville, R. I.

Printing Press

Dexter Folder Co., 200 Fifth Ave., New York, N. Y.

Pulverized Coal

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 69*

FELT GOODS, MECHANICAL

Booth Felt Co., Inc., 400-450 14th St., Brooklyn, N. Y.

FERRULES

Brass

Athol Pump Co., Athol, Mass.

Fibre

*American Vulcanized Fibre Co., Wilmington, Del. *See page 203*

Union

Athol Pump Co., Athol, Mass.

FERTILIZER MACHINERY

Pratt Engineering & Machine Co., Atlanta, Ga.

Sackett, A. J., Baltimore, Md.

Valk & Murdoch Co., Charleston, S. C.

FIBRE (Vulcanized)

*American Vulcanized Fibre Co., Wilmington, Del. *See page 203*

Delaware Hard Fibre Co., Wilmington, Del.

Diamond State Fibre Co., Bridgeport, Pa.

FILES

Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

Simonds Mfg. Co., Fitchburg, Mass.

FILING MACHINES

Extensive Mfg. Co., 90 West St., New York, N. Y.

Die

Cochrane-Bly Co., Rochester, N. Y.

Extensive Mfg. Co., 90 West St., New York, N. Y.

Robinson Tool Works, Inc., Waterbury, Conn.

FILING AND HACKSAW MACHINES (Combined)

Extensive Mfg. Co., 90 West St., New York, N. Y.

FILLER (For Castings)

Clark Cast Steel Cement Co., Shelton, Conn.

FILLETS, LEATHER

Page Belting Co., Concord, N. H.

FILTER PRESSES

(See Presses, Filter)

FILTERS

Beer and Wine

Loew Mfg. Co., 9001 Madison Ave., N. W., Cleveland, O.

Oil

Andrews, Inc., William, 120 Liberty St., New York, N. Y. *See page 84*

Bonar & Co., James, 502 Park Bldg., Pittsburgh, Pa.

Boston Steam Specialty Co., 185 Franklin St., Boston, Mass.

Bousman Mfg. Co., 1153 Plainfield Ave., Grand Rapids, Mich.

Burt Mfg. Co., Akron, O.

Canton Grate Co., 1708 Woodland Ave., Canton, O. *See page 71*

Famous Filter Co., 308 N. Commercial St., St. Louis, Mo.

Flower Co., W. L., 310 South 8th St., St. Louis, Mo.

Koven & Brother, L. O., Jersey City, N. J. *See page 301*

Nugent & Co., Wm. W., 146-148 W. Superior St., Chicago, Ill.

Phoenix Automatic Filter Co., Racine, Wis.

Pittsburgh Gage & Supply Co., Pittsburgh, Pa.

Plouff Co., 1500 River St., Boston, Mass.

Power Plant Specialties, 219 Ruffner St., Lockland, O.

File

See Catalogue Section for data of firms listed in bold face type

FILTERS (continued)**Oil**

- *Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. See page 129
Turner Oil Filter Co., Niles, Mich.

Oil (Centrifugal)

- Oil & Waste Saving Machine Co., 1509 Real Estate Trust Bldg., Philadelphia, Pa. See page 130

Water

- American Water Softener Co., 1011 Chestnut St., Philadelphia, Pa.
Beggs & Co., James, 36 Warren St., New York, N. Y.
Electric Water Sterilizer Co., Scottdale, Pa.
Elliott Co., 6915 Susquehanna St., Pittsburgh, Pa.
Griscom-Russell Co., 90 West St., New York, N. Y.
Hygeia Filter Co., Detroit, Mich.
International Filter Co., Chicago, Ill.
Koven & Brother, L. O., Jersey City, N. J. See page 301
Loomis-Manning Filter Mfg. Co., 1421-1455 S. 37th St., Philadelphia, Pa.
New York Continental Jewell Filtration Co., 15 Broad St., New York, N. Y.
Norwood Engineering Co., Florence, Mass.
Permutit Co., 30 E. 42nd St., New York, N. Y.
Pittsburgh Filter Mfg. Co., Pittsburgh, Pa.
Plouff Co., 1500 River St., Boston, Mass.
Reisert Automatic Water Purifying Co., 30 Church St., New York, N. Y.
Roberts Filter Mfg. Co., Darby, Pa.
Ross Valve Mfg. Co., Troy, N. Y.
*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. See page 75
Watson, N. A., 2016 State St., Erie, Pa.

FILTRATION PLANTS

- International Filter Co., Chicago, Ill.
Kent, Inc., Robert Sayre, 50 Court St., Brooklyn, N. Y.
Norwood Engineering Co., Florence, Mass.
Pittsburgh Filter Mfg. Co., Pittsburgh, Pa.
Roberts Filter Mfg. Co., Darby, Pa.
*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. See page 75

FIRE APPARATUS (Automobile)

- American-La France Fire Engine Co., Inc., Elmira, N. Y.
Buckeye Mfg. Co., Anderson, Ind.

FIRE BRICK, HYDRANTS, SAND, ETC.
(See Brick, Hydrants, Sand, etc., Fire)**FIRE DEPARTMENT SUPPLIES**

- Fabric Fire Hose Co., Cor. Duane & Church Sts., New York, N. Y.
Morse & Son, Inc., Andrew J., 221 High St., Boston, Mass.

FIRE DOOR FIXTURES (Automatic)

- Stowell Co., So. Milwaukee, Wis.

FIRE DOORS (Locomotive, Automatic)

- Franklin Railway Supply Co., 30 Church St., New York, N. Y.

FIRE EXTINGUISHERS

- American-La France Fire Engine Co., Inc., Elmira, N. Y.
Automatic Sprinkler Co. of America, 123 William St., New York, N. Y.
*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. See page 119
Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

FIRE HOSE MACHINERY

- Royle & Sons, John, Paterson, N. J.

FIRE PROTECTION SUPPLIES

- Consumers Rubber Co., 829 Superior Ave., W., Cleveland, O.
Eureka Fire Hose Mfg. Co., 29 Barclay St., New York, N. Y.

FIRE TUBE BOILERS

- (See Boilers, Return and Vertical Tubular)

FITTINGS**Aluminum**

- Aluminum Co. of America, Pittsburgh, Pa. See page 205

Ammonia

- Baker Ice Machine Co., Omaha, Neb.
Buffalo Refrigerating Machine Co., 126 Liberty St., New York, N. Y.
Carbondale Machine Co., Carbondale, Pa. See page 307

- *Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. See page 25
Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
Ruemmeli-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.
Tight Joint Co., 300-310 E. 47th St., New York, N. Y.
Triumph Electric & Ice Machine Co., Cincinnati, O.
Triumph Ice Machine Co., Cincinnati, O.
*Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. See page 277
Vogt Machine Co., Henry, Louisville, Ky. See page 55
York Mfg. Co., York, Pa.

Digester

- Carthage Machine Co., Carthage, N. Y.

Drainage (Cast Iron)

- *Central Foundry Co., 90 West St., New York, N. Y. See page 105
*Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
Essex Foundry, Murray St. & Ave. D, Newark, N. J.
Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Flanged

- American District Steam Co., North Tonawanda, N. Y. See page 118
*Central Foundry Co., 90 West St., New York, N. Y. See page 105
*Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
Direct Separator Co., Syracuse, N. Y.
Essex Foundry, Murray St. & Ave. D, Newark, N. J.
Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
Limbert & Co., Geo. B., 570 Fulton St., Chicago, Ill.
Malleable Iron Fittings Co., Branford, Conn. See page 106
*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
Shaw-Kendall Engineering Co., Toledo, O.
Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Flanged (Steel)

- Essex Foundry, Murray St. & Ave. D, Newark, N. J.

Hard Rubber

- India Rubber Co., New Brunswick, N. J.

Hydraulic

- *Crane Co., 839 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
Elmes Engineering Works, Charles E., 215 N. Morgan St., Chicago, Ill.
*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
Southwark Foundry & Machine Co., Philadelphia, Pa. See page 24
Tight Joint Co., 300-310 E. 47th St., New York, N. Y.
*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Fil

Pipe

- *American Cast Iron Pipe Co., Birmingham, Ala.
 American District Steam Co., North Tonawanda, N. Y. *See page 118*
 Best Co., 3221 Spruce Way, Pittsburgh, Pa.
 *Central Foundry Co., 90 West St., New York, N. Y. *See page 105*
 *Clow & Sons, James B., Chicago, Ill.
 *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 *Donaldson Iron Co., Emaus, Pa.
 Essex Foundry, Murray St. & Ave. D, Newark, N. J.
 *Glamorgan Pipe & Foundry Co., Lynchburg, Va.
 Illinois Malleable Iron Co., 1801 Diversey Parkway, Chicago, Ill.
 Jarecki Mfg. Co., Erie, Pa.
 Jefferson Union Co., Lexington, Mass.
 Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
 *Lynchburg Foundry Co., Lynchburg, Va.
 Malleable Iron Fittings Co., Branford, Conn. *See page 106*
 Mark Mfg. Co., Evanston, Ill.
 *Massillon Iron & Steel Co., Massillon, O.
 McNab & Harlin Mfg. Co., 55 John St., New York, N. Y.
 Milwaukee Valve Co., 139 Burrell St., Milwaukee, Wis.
 National Tube Co., Pittsburgh, Pa.
 Pittsburgh Valve & Fittings Co., Barberton, O.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
 *Standard Cast Iron Pipe & Foundry Co., Bristol, Pa.
 Stoddard Union Co., Lockport, N. Y.
 Tight Joint Co., 306-310 E. 47th St., New York, N. Y.
 *U. S. Cast Iron Pipe & Foundry Co., Philadelphia, Pa.

Railing

- *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
 Pancoast Co., Henry B., 243 & 245 So. 3rd St., Philadelphia, Pa.
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Steel

- *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Malleable Iron Fittings Co., Branford, Conn. *See page 106*
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
 *Walworth Mfg. Co., Boston, Mass.

Union

Dart Mfg. Co., E. M., Providence, R. I.

FLANGED AND DISHED HEADS

(See Heads, Flanged and Dishd)

FLANGES

- American District Steam Co., North Tonawanda, N. Y. *See page 118*
 Bard Union Co., Inc., Norwich, Conn.
 *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Dart Mfg. Co., E. M., Providence, R. I.
 Essex Foundry, Murray St. & Ave. D, Newark, N. J.
 Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
 Malleable Iron Fittings Co., Branford, Conn. *See page 106*
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Cast Steel

- *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Essex Foundry, Murray St. & Ave. D, Newark, N. J.
 Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
 Malleable Iron Fittings Co., Branford, Conn. *See page 106*
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Forged Steel

Tioga Steel & Iron Co., Philadelphia, Pa.

Pressed Steel

- Glasgow Iron Co., Pottstown, Pa. *See page 60*
 Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*

FLANGING

- Glasgow Iron Co., Pottstown, Pa. *See page 60*
 Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*
 Phoenix Iron Works Co., Meadville, Pa. *See page 53*

FLEXIBLE METAL TUBING, SHAFTING, ETC.

(See Metal Tubing, Shafting, etc., Flexible)

FLEXIBLE SHAFT OUTFITS (Portable)

Plank Flexible Shaft Machine Co., 710 Monroe Ave., N. W., Grand Rapids, Mich.

FLOATS, COPPER

Consolidated Mfg. Co., Rear 28 N. Canal St., Dayton, O.

FLOOR PLATES

- Knox Pressed & Welded Steel Co., Pittsburgh, Pa.
 Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

FLOOR STANDS

- *Crane Co., 839 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. *See page 92*
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

FLOOR TREATMENTS (Concrete)

Nightingale & Childs Co., 205 Congress St., Boston, Mass.

FLOORING

Asphalt Mastic

Warren Brothers Co., 142 Berkeley St., Boston, Mass.

Block (Asphalt)

Hastings Pavement Co., 25 Broad St., New York, N. Y. *See page 270*

Cork Composition

Troegerlith Tile Co., 103 Park Ave., New York, N. Y.

FLOUR MILLING MACHINERY

Barnard & Seas Mfg. Co., Moline, Ill.
 Sprout Waldron & Co., Muncy, Pa.

FLOW DETECTORS

Lewis Steam Specialty & Valve Co., Vine St., Philadelphia, Pa.

FLUE CUTTERS

(See Cutters, Flue)

FLUE WELDERS (Pneumatic)

Draper Mfg. Co., Port Huron, Mich.

FLUES, SMOKE

(See Breechings)

FLUSH-TANKS (For Sewage)

Isham Flush Tank Co., Seattle, Wash.

Flu

See Catalogue Section for data of firms listed in alphabetical order

FLY WHEELS

- Bass Foundry & Machine Co.**, Fort Wayne, Ind. *See page 39*
Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*
Pyott Co., 955 Carroll Ave., Chicago, Ill.

FORGES

- Bradley & Son, Inc.**, C. C., Syracuse, N. Y. *See page 216*
Candey-Otto Mfg. Co., Chicago Heights, Ill.
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 256*
***Ingersoll-Rand Co.**, 11 Broadway, New York, N. Y. *See pages 272, 273*
***Roots Co., P. E. & F. M.**, Connersville, Ind. *See pages 282, 283*
Star Mfg. Co., New Lexington, O.

Hand, Portable

- Furness Bros. Co.**, 1615 W. Walnut St., Chicago, Ill.

Oil

- Anthony Co.**, 138 West Ave., Long Island City, N. Y. *See page 264*
***Best, Inc., W. N.**, 11 Broadway, New York, N. Y. *See page 265*
Hauck Mfg. Co., 140 Livingston St., Brooklyn, N. Y.
Mirco Fuel Oil Equipment Co., Lancaster, Pa.

Rivet

- Anthony Co.**, 138 West Ave., Long Island City, N. Y. *See page 264*
Furness Bros. Co., 1615 W. Walnut St., Chicago, Ill.

FORGE SHOP EQUIPMENT

- Buffalo Forge Co.**, 490 Broadway, Buffalo, N. Y.

FORGING MACHINES

- Bliss Co., E. W.**, 19 Adams St., Brooklyn, N. Y. *See page 212*
Scranton & Co., New Haven, Conn.
Williams, White & Co., Moline, Ill. *See page 215*

Fly FORGINGS**Drop**

- Barcalo Mfg. Co.**, Buffalo, N. Y.
Billings & Spencer, Hartford, Conn.
Bradley & Son, Inc., C. C., Syracuse, N. Y. *See page 216*
Cleveland City Forge & Iron Co., Cleveland, O.
General Drop Forge Co., 1738 Elmwood Ave., Buffalo, N. Y.
Hockensmith Wheel & Mine Car Co., Penns Station, Pa.
Keystone Drop Forge Works, Central & Delaware Aves., Chester, Pa.
Ladish-Obenberger Co., Cudahy, Wis.
Liggett Spring & Axle Co., Monongahela, Pa.
Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*
Ohio Forge Co., Cleveland, O.
Page-Storms Drop Forge Co., Chicopee, Mass.
Steel Car Forge Co., Frick Bldg., Pittsburgh, Pa.
Vogt Machine Co., Henry, Louisville, Ky. *See page 55*
Whitman & Barnes Mfg. Co., Akron, O.

Hammered

- Johnston & Jennings Co.**, Cleveland, O.
Ladish-Obenberger Co., Cudahy, Wis.

Hand

- Newhall Chain Forge & Iron Co.**, 90 West St., New York, N. Y. *See page 173*

Iron and Steel

- Bass Foundry & Machine Co.**, Fort Wayne, Ind. *See page 39*
Braeburn Steel Co., Braeburn, Pa.
Frost Gear & Forge Co., Jackson, Mich.
General Drop Forge Co., 1738 Elmwood Ave., Buffalo, N. Y.
McInnes Steel Co., Ltd., Corry, Pa.

- Pittsburgh Forge & Iron Co.**, 1003 Penn Ave., Pittsburgh, Pa.
Steel Car Forge Co., Frick Bldg., Pittsburgh, Pa.
Strait Mfg. Co., H. N., Kansas City, Kan.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

- Tioga Steel & Iron Co.**, Philadelphia, Pa.
Williams & Co., J. H., Brooklyn, N. Y.

FORMING MACHINES (Automatic)

- Cleveland Automatic Machine Co.**, 2269 Ashland Road, Cleveland, O.

FORMS (Steel, Concrete)

- Blaw Steel Construction Co.**, Pittsburgh, Pa.

FOUNDRY EQUIPMENT

- Anthony Co.**, 138 West Ave., Long Island City, N. Y. *See page 264*
Hay's Sons, Sam'l W., 1408-9 Keenan Bldg., Pittsburgh, Pa.
Leyshon & Lane, Inc., Trussed Concrete Bldg., Detroit, Mich.
Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*
***Northern Engineering Works**, Detroit, Mich.
Obermayer Co., S., 2563 W. 18th St., Chicago, Ill.
***Whiting Foundry Equipment Co.**, Harvey, Ill.

FOUNDRY FACING

(See Facings, Foundry)

FOUNDRY SUPPLIES

- Hill & Griffith Co.**, Box 540, Birmingham, Ala.

FRICTION CLUTCHES

(See Clutches, Friction)

FRICTIONS**Fibre**

- *American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*

Paper and Iron

- *Caldwell & Son Co., H. W.**, 17th St. & Western Ave., Chicago, Ill. *See page 174*
***Falls Clutch & Machinery Co.**, Cuyahoga Falls, O. *See page 143*
Rockwood Mfg. Co., Indianapolis, Ind.
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

FROGS AND CROSSINGS

- Bethlehem Steel Co.**, South Bethlehem, Pa.
Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

FUEL ECONOMIZERS, GAS PLANTS, ETC.

(See Economizers, Gas Plants, etc., Fuel)

FURNACES**Annealing and Tempering**

- American Incandescent Heat Co., Inc.**, 10 Post Office Square, Boston, Mass.
Beach-Russ Co., 220 Broadway, New York, N. Y.
***Best, Inc., W. N.**, 11 Broadway, New York, N. Y. *See page 265*
Eclipse Fuel Engineering Co., Rockford, Ill.
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*
Kenworthy, Charles F., Waterbury, Conn.
Scott, C. U., Head of Wall St., Davenport, Ia.
Surface Combustion Co., Wilbur Ave. & Sunswick St., Long Island City, N. Y.
Tate, Jones & Co., Inc., Pittsburgh, Pa.

Billet Heating

- Kenworthy, Charles F.**, Waterbury, Conn.

Blast

- *Mohr & Sons, John**, 349-359 W. Illinois St., Chicago, Ill. *See page 51*

Boiler

- *Best, Inc., W. N.**, 11 Broadway, New York, N. Y. *See page 265*
Betson Plastic Fire Brick Co., Rome, N. Y.

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

MECHANICAL EQUIPMENT DIRECTORY

Detroit Stoker Co., Detroit, Mich. *See page 62*
***Green Engineering Co.**, East Chicago, Ind. *See pages 64, 65*
Improved Combustion Co., Peoples Gas Bldg., Chicago, Ill.
Keystone Stoker Co., Greenfield, Mass.
McKenzie Furnace Co., 647 McCormick Bldg., Chicago, Ill.
***Murphy Iron Works**, Detroit, Mich. *See pages 66, 67*
Swan, John F., 10th & Duncannon Sts., Philadelphia, Pa.
Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*
***Wetzel Mechanical Stoker Co.** of New York, Inc., 30 Church St., New York, N. Y.
Woolson, Orosco C., 39 Cortlandt St., New York, N. Y.

Case Hardening

American Incandescent Heat Co., Inc., 10 Post Office Square, Boston, Mass.

Down-Draft

O'Brien Boiler Works Co., John, 1601 N. 11th St., St. Louis, Mo.
Swan, John F., 10th & Duncannon Sts., Philadelphia, Pa.

Electric

Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*
Engelhard, Charles, 30 Church St., New York, N. Y.
Hanovia Chemical & Mfg. Co., Chestnut St. & N. J. Railroad Ave., Newark, N. J.
Hoskins Mfg. Co., 453-471 Lawton Ave., Detroit, Mich.
Leeds & Northrup Co., Philadelphia, Pa.

Enameling

National Gas Furnace Co., Providence, R. I.

Forging

American Shop Equipment Co., McCormick Bldg., Chicago, Ill.
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*
Mirco Fuel Oil Equipment Co., Lancaster, Pa.
Tate, Jones & Co., Inc., Pittsburgh, Pa.

Gas

American Gas Furnace Co., 24 John St., New York, N. Y.
Chicago Flexible Shaft Co., 579 La Salle Ave., Chicago, Ill.
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*
Koven & Brother, L. O., Jersey City, N. J. *See page 301*
Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
National Gas Furnace Co., Providence, R. I.
Standard Gas Power Co., 17 Battery Place, New York, N. Y.

Hardening

American Incandescent Heat Co., Inc., 10 Post Office Square, Boston, Mass.
Buffalo Dental Mfg. Co., 587-589 Main St., Buffalo, N. Y.

Heat Treating

American Shop Equipment Co., McCormick Bldg., Chicago, Ill.
***Best, Inc., W. N.**, 11 Broadway, New York, N. Y. *See page 265*
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*
Kenworthy, Charles F., Waterbury, Conn.
Metals Production Equipment Co., 105 W. 40th St., New York, N. Y.
Surface Combustion Co., Wilbur Ave. & Sunswick St., Long Island City, N. Y.

Laboratory

Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

Melting

***Best, Inc., W. N.**, 11 Broadway, New York, N. Y. *See page 265*
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*
Koven & Brother, L. O., Jersey City, N. J. *See page 301*
Leyshon & Lane, Inc., Trussed Concrete Bldg., Detroit, Mich.
***Locomotive Pulverized Fuel Co.**, 30 Church St., New York, N. Y.
Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

Muffle

***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*

Non-Oxidizing

Kenworthy, Charles F., Waterbury, Conn.

Oil

American Shop Equipment Co., McCormick Bldg., Chicago, Ill.
Anthony Co., 138 West Ave., Long Island City, N. Y. *See page 264*
***Best, Inc., W. N.**, 11 Broadway, New York, N. Y. *See page 265*
Chicago Flexible Shaft Co., 579 La Salle Ave., Chicago, Ill.
***Gilbert & Barker Mfg. Co.**, Springfield, Mass. *See page 266*
***Ingersoll-Rand Co.**, 11 Broadway, New York, N. Y. *See pages 272, 273*
Johnson Co., S. T., 1337 Mission St., San Francisco, Cal.
Macleod Co., Cincinnati, O.
National Supply Co., 416 W. Grand Ave., Chicago, Ill.
Tate, Jones & Co., Inc., Pittsburgh, Pa.

Refining

American Incandescent Heat Co., Inc., 10 Post Office Square, Boston, Mass.

Reheating

American Incandescent Heat Co., Inc., 10 Post Office Square, Boston, Mass.

Rivet

Eclipse Fuel Engineering Co., Rockford, Ill.

Scaling

American Incandescent Heat Co., Inc., 10 Post Office Square, Boston, Mass.

Smokeless

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*
American Foundry & Casting Co., Dayton, O.
Burke Furnace Co., 223 W. Austin Ave., Chicago, Ill.
Chicago Tile Arch Furnace Co., 321-323 W. Austin Ave., Chicago, Ill.
Crowe, Paul L., 33 Bidwell Ave., Jersey City, N. J.
Detroit Stoker Co., Detroit, Mich.
***Green Engineering Co.**, East Chicago, Ind. *See pages 64, 65*
Illinois Stoker Co., Alton, Ill.
***Locomotive Pulverized Fuel Co.**, 30 Church St., New York, N. Y.
McKenzie Furnace Co., 647 McCormick Bldg., Chicago, Ill.
***Murphy Iron Works**, Detroit, Mich. *See pages 66, 67*
***Riley Stoker Co., Ltd.**, Sanford, Worcester, Mass.
Swan, John F., 10th & Duncannon Sts., Philadelphia, Pa.
Twin Fire Furnace Co., 38 S. Dearborn St., Chicago, Ill.

Steel

American Bridge Co., 30 Church St., New York, N. Y.
Scott, C. U., Head of Wall St., Davenport, Ia.

See Catalogue Section for data of firms listed in bold face type

FURNACES (continued)

Syrup (Maple, Sorghum)

Cook Cane Mill & Evaporator Co., 320 No. 2nd St., St. Louis, Mo.

FUSES

Detroit Fuse & Mfg. Co., 1400-1414 Rivard St., Detroit, Mich.

D & W Fuse Co., Providence, R. I. *See page 253**General Electric Co., Schenectady, N. Y. *See pages 30, 31**Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Johns-Pratt Co., 555 Capitol Ave., Hartford, Conn.

FUSIBLE PLUGS

(See Plugs, Fusible)

G**GAGE BOARDS**American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322**Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329***GAGE GLASS PROTECTORS**

Plouff Co., 1500 River St., Boston, Mass.

GAGE GLASSES

Durable Mfg. Co., 114 Liberty St., New York, N. Y.

Hill Pump Valve Co., Archer Ave., Chicago, Ill.

Prismatic

Kern Commercial Co., 114 Liberty St., New York, N. Y.

Fur GAGE TESTERSAmerican Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322**Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*

Quimby Engineering Co., 915 Ridge Ave., Philadelphia, Pa.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*

Simplex Tester Co., Harvard Square, Cambridge, Mass.

GAGES (Indicating, Recording)**Absolute Pressure**Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. *See page 321***Altitude**American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*

National Gauge & Equipment Co., La Crosse, Wis.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329***Ammonia**American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322**Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*

Nason Mfg. Co., 71 Fulton St., New York, N. Y.

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*

Watertown Specialty Co., Watertown, N. Y.

Differential PressureAmerican Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*

*Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.

*Bailey Meter Co., 141 Milk St., Boston, Mass. *See page 318*

Blonck & Co., W. A., Fisher Bldg., Chicago, Ill.

*Bristol Co., Waterbury, Conn. *See page 327**Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo. *See page 319*

Duemier, G. Frank, 837 Sanger St., Philadelphia, Pa.

*Precision Instrument Co., Detroit, Mich. *See page 320*Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. *See page 321***Draft**American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322**Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323**Bristol Co., Waterbury, Conn. *See page 327*

*Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.

*Bailey Meter Co., 141 Milk St., Boston, Mass. *See page 318*Brown Instrument Co., Philadelphia, Pa. *See page 328*

Combustion Appliance Co., 1778 Estes Ave., Chicago, Ill.

Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324**Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo. *See page 319*

Ellison, Lewis M., 214 W. Kinzie St., Chicago, Ill.

McNab Co., Bridgeport, Conn.

*Precision Instrument Co., Detroit, Mich. *See page 320*

Sargent Steam Meter Co., 1902 N. California Ave., Chicago, Ill.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*

*Scientific Materials Co., 711-719 Forbes St., Pittsburgh, Pa.

Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330**Taylor Instrument Cos., Rochester, N. Y. *See page 331*Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. *See page 321***Hydraulic**American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322**Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*

Bogardus-Nelson Co., Marshalltown, Ia.

Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329***Measuring (Surface, Depth, Dial, etc.)***Atlas Ball Co., Glenwood Ave. at 4th St., Philadelphia, Pa. *See page 159**Cordrey Machine Works, C. H., Fitchburg, Mass. *See page 236*

*Greenfield Tap and Die Corp'n, Greenfield, Mass.

Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn. *See page 237*

Hartford Special Machinery Co., Hartford, Conn.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Leavitt Machine Co., Orange, Mass.
 Mehl Machine, Tool & Die Co., Roselle, N. J. See pages 238, 239
 Nestor Mfg. Co., 40 W. 13th St., New York, N. Y.

*Norma Co. of America, 1790 Broadway, New York, N. Y. See page 158
 Pratt & Whitney Co., Hartford, Conn.
 Sloan & Chace Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. See page 233
 Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y. See page 337
 Swedish Gage Co., Inc., Locomobile Bldg., New York, N. Y.
 Taft-Peirce Mfg. Co., Woonsocket, R. I.

Oxy-Acetylene

United States Gauge Co., 67 Wall St., New York, N. Y. See page 326

Pressure

American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322
 Ashcroft Mfg. Co., 119 W. 40th St., New York, N. Y.
 *Ashton Valve Co., 271 Franklin St., Boston, Mass. See page 323
 *Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.
 *Bailey Meter Co., 141 Milk St., Boston, Mass. See page 318
 Bogardus-Nelson Co., Marshalltown, Ia.
 *Bristol Co., Waterbury, Conn. See page 327
 Brown Instrument Co., Philadelphia, Pa. See page 328
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324
 *Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo. See page 319
 Improved Gauge Mfg. Co., 300 W. Water St., Syracuse, N. Y.
 Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325
 Meriam Co., 1514 Prospect Ave., S. E., Cleveland, O.
 Marsh & Co., Jas. P., 118-124 S. Clinton St., Chicago, Ill.
 National Gauge Co., 300 Pacific St., Brooklyn, N. Y.
 National Gauge & Equipment Co., La Crosse, Wis.
 National Steam Specialty Co., 12 S. Clinton St., Chicago, Ill.
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. See page 329
 *Smith Gas Engineering Co., Lexington, O.
 *Taylor Instrument Cos., Rochester, N. Y. See page 331
 Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. See page 321
 United States Gauge Co., 67 Wall St., New York, N. Y. See page 326

Pressure (Gas Engine)

Loomis, O. P., Newport News, Va.

Rate of Flow

*Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.

Universal

United States Gauge Co., 67 Wall St., New York, N. Y. See page 326

Vacuum

American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322
 Ashcroft Mfg. Co., 119 W. 40th St., New York, N. Y.
 *Ashton Valve Co., 271 Franklin St., Boston, Mass. See page 323
 Bogardus-Nelson Co., Marshalltown, Ia.
 *Bristol Co., Waterbury, Conn. See page 327
 Brown Instrument Co., Philadelphia, Pa. See page 328
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324

Improved Gauge Mfg. Co., 300 W. Water St., Syracuse, N. Y.
 Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325
 National Steam Specialty Co., 12 S. Clinton St., Chicago, Ill.

*Precision Instrument Co., Detroit, Mich. See page 320
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. See page 329
 Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. See page 330
 *Taylor Instrument Cos., Rochester, N. Y. See page 331
 Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. See page 321

Volume

*Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.

Water

American Injector Co., Detroit, Mich. See page 116
 American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322
 *Ashton Valve Co., 271 Franklin St., Boston, Mass. See page 323
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324
 Detroit Lubricator Co., Detroit, Mich. See page 125
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
 Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325
 Nott Iron & Brass Works, H. L., White River Junction, Vt.
 Penberthy Injector Co., Detroit, Mich. See page 117
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 Rich Mfg. Co., 370 Atlantic Ave., Boston, Mass.
 Sargent Co., Fisher Bldg., Chicago, Ill.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Watertown Specialty Co., Watertown, N. Y.
 Williams Gauge Co., 543 Fourth Ave., Pittsburgh, Pa.

Water Level

*Bristol Co., Waterbury, Conn. See page 327
 Hydro Mfg. Co., 320 Bullitt Bldg., Philadelphia, Pa.

GALVANIZING

Koven & Brother, L. O., Jersey City, N. J. See page 301
 Malleable Iron Fittings Co., Branford, Conn. See page 106
 Scott, C. U., Head of Wall St., Davenport, Ia.

GALVANOMETERS

*Taylor Instrument Cos., Rochester, N. Y. See page 331
 Thompson-Levering Co., 323 Arch St., Philadelphia, Pa.
 Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. See page 332

GARBAGE BURNERS

(See Destructors, Refuse)

GAS ANALYSIS APPARATUS

Combustion Appliances Co., 1778 Estes Ave., Chicago, Ill.
 *Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo. See page 319
 Duemler, G. Frank, 837 Sanger St., Philadelphia, Pa.
 Dwight Mfg. Co., 12-14 So. Jefferson St., Chicago, Ill.
 Eimer & Amend, 205-211 Third Ave., New York, N. Y. See page 333

Gas

See Catalogue Section for data of firms listed in bold face type

GAS ANALYSIS APPARATUS (continued)

Pierce Co., William B., 45 N. Division St., Buffalo, N. Y.

*Precision Instrument Co., Detroit, Mich. See page 320

Simonds & Co., G. L., 230 S. La Salle St., Chicago, Ill.

Thomas Co., Arthur H., W. Washington Sq., Philadelphia, Pa.

Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. See page 321

GAS BURNERS, COMPRESSORS, ENGINES, EXHAUSTERS, PRODUCERS, ETC.

(See Burners, Compressors, Engines, Exhausters, Producers, etc., Gas)

GAS BURNING EQUIPMENT

Gwynn Gas Burner & Engrg. Co., 713-714 Empire Bldg., Pittsburgh, Pa. See page 70

Selas Co., 521 W. 23rd St., New York, N. Y. See page 267

GAS CLEANING PLANTS

Coal & Coke By Products Co., 421 Wood St., Pittsburgh, Pa.

*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

GAS COLLECTORS

Duemler, G. Frank, 837 Sanger St., Philadelphia, Pa.

*Precision Instrument Co., Detroit, Mich. See page 320

GAS DETECTORS (Mine)

Quimby Engineering Co., 915 Ridge Ave., Philadelphia, Pa.

GAS ENGINE ACCESSORIES

Accurate Engineering Co., Chicago, Ill.

GAS PLANT MACHINERY

Bartlett Hayward Co., Baltimore, Md.

Connelly Iron Sponge & Governor Co., 127 Duane St., New York, N. Y.

Standard Gas Power Co., 17 Battery Place, New York, N. Y.

*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Producer

Chapman Engineering Co., Mt. Vernon, O.
Coal & Coke By Products Co., 421 Wood St., Pittsburgh, Pa.

*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

GAS PLANTS**Blue**

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

Coal

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

Oil

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

Producer

Amsler Gas Power Co., Wabash Bldg., Pittsburgh, Pa.

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

*Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Water, Carburetted

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

United Gas Improvement Co., Broad & Arch Sts., Philadelphia, Pa.

GAS PURIFYING MATERIAL

Connelly Iron Sponge & Governor Co., 127 Duane St., New York, N. Y.

GASKETS

Advance Packing & Supply Co., Chicago, Ill.

Flexitall Gasket Co., Camden, N. J.

Garlock Packing Co., Palmyra, N. Y.

Gasket Supply Co., 1729 Ludlow St., Philadelphia, Pa.

*Greene, Tweed & Co., 109 Duane St., New York, N. Y. See page 126

Guillot Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

Standard Mfg. & Supply Co., 30 N. 4th St., Philadelphia, Pa.

Wilcox Mfg. Co., E. A., 6330 Stony Island Ave., Chicago, Ill.

Ammonia

Guillot Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

Asbestos

Burgmann Asbestos & Packing Mills, Feodor, 26 Cortlandt St., New York, N. Y.

Cincinnati Gasket & Packing Co., 1546-1548 Elm St., Cincinnati, O.

Durable Mfg. Co., 114 Liberty St., New York, N. Y.

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. See page 119

Standard Mfg. & Supply Co., 30 N. 4th St., Philadelphia, Pa.

Copper, Corrugated

Guillot Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

U. S. Mineral Wool Co., 280 Madison Ave., New York, N. Y.

Fibre

Fibre Finishing Co., 27 State St., Boston, Mass.

Lead

Akron Metallic Gasket Co., 152 N. Union St., Akron, O.

Guillot Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

United Lead Co., 111 Broadway, New York, N. Y. See page 202

Leather

Graton & Knight Mfg. Co., Worcester, Mass. See page 166

Metal and Combination

Akron Metallic Gasket Co., 152 N. Union St., Akron, O.

Cincinnati Gasket & Packing Co., 1546-1548 Elm St., Cincinnati, O.

Goetze Gasket & Packing Co., New Brunswick, N. J.

Guillot Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

Metallic

Akron Metallic Gasket Co., 152 N. Union St., Akron, O.

Guillot Metal Gasket & Supply Co., 24 S. Clinton St., Chicago, Ill.

McCord Mfg. Co., Detroit, Mich. See page 127

Rubber

Boston Belting Co., 84 Linden Park St., Boston, Mass. See page 162

Cincinnati Gasket & Packing Co., 1546-1548 Elm St., Cincinnati, O.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91

*Goodrich Co., B. F., Akron, O. See pages 133, 165

*Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97

Knowlton Rubber Co., Geo. W., 60 Pearl St., Boston, Mass.

Mechanical Rubber Co., Cleveland, O. See page 169

Vulcanized Fibre

*American Vulcanized Fibre Co., Wilmington, Del. See page 203

GASOLENE

Texas Co., 17 Battery Pl., New York, N. Y. See page 124

GASOLENE STORAGE OUTFITS

American Oil Pump & Tank Co., Central & Kindel Aves., Cincinnati, O.

Gas

Advertisements of firms marked * appear in The Journal, A. S. M. E.

GASOLINE TANK EQUIPMENT

National Gauge & Equipment Co., La Crosse, Wis.

GATE HOISTS

(See Hoists, Gate)

GATES**Blast**American Blower Co., Detroit, Mich. *See pages 280, 281**Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283***Cut-Off***Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174**Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177**Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*Link-Belt Co., Chicago, Ill. *See page 178***Head**

Davis Foundry & Machine Works, Rome, Ga.

Jolly, Inc., J. & W., Holyoke, Mass.

Shear

Coldwell-Wilcox Co., Newburgh, N. Y.

Sluice

Coffin Valve Co., Neponset, Mass.

Coldwell-Wilcox Co., Newburgh, N. Y.

Hunt Machine Co., Rodney, Orange, Mass.

Kennedy Valve Mfg. Co., 1100 E. Water Co., Elmira, N. Y. *See page 98*

*Ludlow Valve Mfg. Co., Troy, N. Y.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99**Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295***GEAR CLEANING AND GRINDING WHEELS**

Upton & Gilman Machine Co., 587 Middlesex St., Lowell, Mass.

GEAR CUTTING MACHINES

Flather Mfg. Co., E. J., Nashua, N. H.

Gleason Works, 1019 University Ave., Rochester, N. Y.

Gould & Eberhardt, Newark, N. J.

Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J.

Sloan & Chace Mfg. Co., Ltd., 6th Ave. Cor. N. 13th St., Newark, N. J. *See page 233*

Standard Mfg. Co., Bridgeport, Conn.

Waltham Machine Works, 296 Newton St., Waltham, Mass.

Whiton Machine Co., D. E., New London, Conn.

GEAR GENERATORS

Bilgram Machine Works, 1235 Spring Garden St., Philadelphia, Pa.

Lees-Bradner Co., 6210 Carnegie Ave., Cleveland, O.

GEAR HOBBING MACHINES

Adams Co., Dubuque, Iowa.

Gould & Eberhardt, Newark, N. J.

Meisselbach-Catucci Mfg. Co., 29 Congress St., Newark, N. J.

Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J.

Reynolds Pattern & Machine Co., 101-103 Third Ave., Moline, Ill.

GEAR SHAPERS*Fellows Gear Shaper Co., Springfield, Vt. *See page 230***GEAR TEETH BLANKS, HICKORY**

Minton & Son, T. W., Barboursville, Ky.

GEAR TEMPERING MACHINES

Gleason Works, 1019 University Ave., Rochester, N. Y.

GEARS**Automobile**

Grant Gear Works, 151 Pearl St., Boston, Mass.

Turley Gear & Machine Co., 1505 N. 10th St., St. Louis, Mo.

Cloth*General Electric Co., Schenectady, N. Y. *See pages 30, 31***Cut**

Bilgram Machine Works, 1235 Spring Garden St., Philadelphia, Pa.

Blount Engineering Co., 100 High St., Boston, Mass.

Bretting Mfg. Co., C. G., Ashland, Wis.

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136**Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

Carpenter-Tew Gear Co., 67 35th St., Brooklyn, N. Y.

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*

Cross Gear & Engine Co., 800-806 Bellevue Ave., Detroit, Mich.

Detroit Gear & Machine Co., 127 Franklin St., Detroit, Mich.

Falk Co., Milwaukee, Wis. *See pages 138, 139*

Fawcus Machine Co., Pittsburgh, Pa.

Foote Bros. Gear & Machine Co., 210-220 N. Carpenter St., Chicago, Ill.

Frost Gear & Forge Co., Jackson, Mich.

Ganschow Co., William, Chicago, Ill.

Grant Gear Works, 151 Pearl St., Boston, Mass.

*Hill Clutch Co., Cleveland, O. *See page 148*

Hindley Gear Co., 1105 Frankford Ave., Philadelphia, Pa.

*James Mfg. Co., D. O., 1120-24 West Monroe St., Chicago, Ill.

Meisel Press Mfg. Co., 950 Dorchester Ave., Boston, Mass.

Meisselbach-Catucci Mfg. Co., 29 Congress St., Newark, N. J.

*New Process Gear Corp'n, Syracuse, N. Y.

Nilson-Miller Co., 1300 Hudson St., Hoboken, N. J.

Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*

Philadelphia Gear Works, Philadelphia, Pa.

Plamondon Mfg. Co., A., 24 N. Clinton St., Chicago, Ill.

Poole Engineering & Machine Co., Baltimore, Md.

Schultz & Son, A. L., 1675 Elston Ave., Chicago, Ill.

Simonds Mfg. Co., Pittsburgh, Pa.

Tichenor Gear Works, F. C., 217 S. Madison Ave., Peoria, Ill.

Turley Gear & Machine Co., 1505 N. 10th St., St. Louis, Mo.

Van Dorn & Dutton Co., Cleveland, O. *See page 141***Fibre***American Vulcanized Fibre Co., Wilmington, Del. *See page 203*

Delaware Hard Fibre Co., Wilmington, Del.

Herringbone

Earle Gear & Machine Co., Philadelphia, Pa.

Falk Co., Milwaukee, Wis. *See pages 138, 139*

Fawcus Machine Co., Pittsburgh, Pa.

Kerr Turbine Co., Wellsville, N. Y. *See page 29*Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*

Sauer Power Generating Co., 5115-19 Rosetta St., Pittsburgh, Pa.

Van Dorn & Dutton Co., Cleveland, O. *See page 141***Internal Herringbone**Turbo-Gear Co., Inc., Baltimore, Md. *See page 140***Molded***Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136**See Catalogue Section for data of firms listed in bold face type*

GEARS (continued)**Molded**

- *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
 National Gear Wheel Foundry, Walker & South Ave., N. S., Pittsburgh, Pa.
 Poole Engineering & Machine Co., Baltimore, Md.
 Pyott Co., 955 Carroll Ave., Chicago, Ill.
 Union Iron Wks., 15 Oak St., Bangor, Me.
 Van Dorn & Dutton Co., Cleveland, O. *See page 141*
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Railway Motor

- *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*
 Van Dorn & Dutton Co., Cleveland, O. *See page 141*

Rawhide

- Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.
 Grant Gear Works, 151 Pearl St., Boston, Mass.
 Meisel Press Mfg. Co., 950 Dorchester Ave., Boston, Mass.
 *New Process Gear Corp'n, Syracuse, N. Y.
 Philadelphia Gear Works, Philadelphia, Pa.
 Western Rawhide & Belting Co., Milwaukee, Wis.

Reverse (Marine)

- Johnson Machine Co., Carlyle, 52 Main St., Manchester, Conn.
 Paragon Gear Works, Taunton, Mass.

Speed Reduction

- De Laval Steam Turbine Co., Trenton, N. J.
 Fawcuss Machine Co., Pittsburgh, Pa.
 Foote Bros. Gear & Machine Co., 210-220 N. Carpenter St., Chicago, Ill.
 *James Mfg. Co., D. O., 1120-24 West Monroe St., Chicago, Ill.
 Kerr Turbine Co., Wellsville, N. Y. *See page 29*
 Sauer Power Generating Co., 5115-19 Rosetta St., Pittsburgh, Pa.
 Turbo-Gear Co., Inc., Baltimore, Md. *See page 140*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steel

- Falk Co., Milwaukee, Wis. *See pages 138, 139*
 Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*
 Tool Steel Gear & Pinion Co., Cincinnati, O.
 Van Dorn & Dutton Co., Cleveland, O. *See page 141*

Worm

- Albro-Clem Elevator Co., 7th St. & Glenwood Ave., Philadelphia, Pa.
 Baush Machine Tool Co., Springfield, Mass.
 Bayard & Co., M. L., Woodbine, N. J.
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 *Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*
 Cleveland Worm & Gear Co., Cor. Payve Ave. & E., 40th St., Cleveland, O.
 Hindley Gear Co., 1105 Frankford Ave., Philadelphia, Pa.
 Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*
 Philadelphia Gear Works, Philadelphia, Pa.
 Van Dorn & Dutton Co., Cleveland, O. *See page 141*
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

GENERATING SETS

- American Blower Co., Detroit, Mich. *See page 280*

Engberg's Electric & Mechanical Works, St. Joseph, Mich.

- Foy & Bowen Engine Co., Geneva, N. Y.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Mietz Machine Works, August, 123 Mott St., New York, N. Y. *See page 27*
 Rochester Motors Co., Inc., Rochester, N. Y.
 Sturtevant Co., B. F., Boston, Mass.
 Universal Motor Co., Oshkosh, Wis.
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATOR COOLING SYSTEMS

- Carrier Air Conditioning Co., 490 Broadway, Buffalo, N. Y.
 *Spray Engineering Co., 93 Federal St., Boston, Mass. *See page 87*

GENERATORS**Acetylene**

- Delcampe Welding Co., Bridgeport, Conn.
 Henderson-Willis Welding & Cutting Co., 2305-7-9 N. 11th St., St. Louis, Mo.
 Milburn Co., Alexander, 1420-1426 W. Baltimore St., Baltimore, Md.
 Modern Engineering Co., 14th & St. Charles Sts., St. Louis, Mo.
 Ottumwa-Moline Engine & Pump Co., 802-822 Madison Ave., Ottumwa, Ia.
 Oxy-Carbi Co., New Haven, Conn.

Electric

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 C. & C. Electric & Mfg. Co., Garwood, N. J.
 Clark, Jr., Electric Co., Jas., Louisville, Ky.
 *Crocker-Wheeler Co., Ampere, N. J. *See page 32*
 Diehl Mfg. Co., Elizabethport, N. J.
 Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.
 Eck Dynamo & Motor Co., Belleville, N. J.
 Electric Machinery Co., Minneapolis, Minn.
 Fidelity Electric Co., Lancaster, Pa.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Jantz & Leist Electric Co., Cincinnati, O.
 Kester Electric Co., 1000-1020 S. 14th St., Terre Haute, Ind.
 Mechanical Appliance Co., Milwaukee, Wis.
 Ridgway Dynamo & Engine Co., Ridgway, Pa.
 Robbins & Myers Co., Springfield, O.
 Rochester Motors Co., Inc., Rochester, N. Y.
 *Sprague Electric Works, 527 W. 34th St., New York, N. Y.
 Terry Steam Turbine Co., Hartford, Conn.
 Western Electric Co., Inc., 195 Broadway, New York, N. Y.
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Hydrogen

- International Oxygen Co., 115 Broadway, New York, N. Y.

Low Voltage

- *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Jantz & Leist Electric Co., Cincinnati, O.

Oxygen

- International Oxygen Co., 115 Broadway, New York, N. Y.
 Shriver & Co., T., 842 Hamilton St., Harrison, N. J.

Thermalene

- Thermalene Co., 17th St. & Lowe Ave., Chicago Heights, Ill.

GLASS BEVELING MACHINERY

- Acton, John, 114 John St., Brooklyn, N. Y.

GLASS BLOWING

- Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

GLASS BLOWING MACHINERY

- Cox & Sons Co., Bridgeton, N. J.

Gea

GLASS CUTTING WHEELSNorton Co., Worcester, Mass. *See page 249***GLASSES (Tubes and Cylinders)**

Advance Packing & Supply Co., Chicago, Ill.

GLASSWARE (Chemical)

American Apparatus Corp'n, 9-11 E. 16th St.,

New York, N. Y. *See page 334*

Eimer & Amend, 205-211 Third Ave., New

York, N. Y. *See page 335***GLUING AND SEALING MACHINES, CAR-**TON
Union Engineering Co., 1616 Columbus Rd.,

Cleveland, O.

GOLD DREDGING MACHINERY

Union Iron Works Co., 214 Spear St., San

Francisco, Cal.

GOLD MILLING MACHINERY

Mecklenburg Iron Works, Charlotte, N. C.

GOVERNORS**Air Compressor**Gardner Governor Co., Quincy, Ill. *See page*

274

Jarecki Mfg. Co., Erie, Pa.

Judson Governor Co., Rochester, N. Y.

National Brake & Electric Co., Milwaukee,

Wis. *See pages 278, 279***Engine (Gas and Steam)**

Bayard & Co., M. L., Woodbine, N. J.

Gardner Governor Co., Quincy, Ill. *See page*

274

Jarecki Mfg. Co., Erie, Pa.

Judson Governor Co., Rochester, N. Y.

Lombard Governor Co., Ashland, Mass.

Massey Machine Co., Watertown, N. Y.

*Pickering Governor Co., Portland, Conn.

See page 131

Sinker Davis Co., Indianapolis, Ind.

Vicksburg Governor Co., Vicksburg, Mich.

Waters Governor Co., 1122 Oliver Bldg.,

Boston, Mass.

Gas

Chaplin-Fulton Mfg. Co., 28-34 Penn Ave.,

Pittsburgh, Pa.

Connelly Iron Sponge & Governor Co., 127

Duane St., New York, N. Y.

Luther Mfg. Co., Olean, N. Y.

Pump

Acton, John, 118 John St., Brooklyn, N. Y.

Albany Steam Trap Co., 317 N. Pearl St.,

Albany, N. Y.

Atlas Valve Co., Inc., 90 West St., New York,

N. Y.

Central Machine Co., 7th, Wood & Franklin

Sts., Philadelphia, Pa.

Chaplin-Fulton Mfg. Co., 28-34 Penn Ave.,

Pittsburgh, Pa.

*Davis Regulator Co., G. M., 422 Milwaukee

Ave., Chicago, Ill.

D'Este Co., Julian, 26 Canal St., Boston, Mass.

*See page 108*Dunham Co., C. A., Marshalltown, Ia. *See**pages 112, 113*

Erie Pump & Equipment Co., Erie, Pa.

Fisher Governor Co., Marshalltown, Pa.

Foster Engineering Co., Newark, N. J. *See**page 109*Gardner Governor Co., Quincy, Ill. *See page*

274

Kieley & Mueller, Inc., 34 W. 13th St., New

York, N. Y. *See page 110*

Kitts Mfg. Co., 19-21 W. Seneca St., Oswego,

N. Y.

McDonough Automatic Regulator Co., De-

troit, Mich.

Mason Regulator Co., Boston, Mass.

*Richardson-Phenix Co., 128 Reservoir Ave.,

Milwaukee, Wis. *See page 129*

"S-C" Regulator Co., Fostoria, O.

Schade Valve Mfg. Co., 2542 N. American St.,

Philadelphia, Pa.

Shopp & Co., W. A., New Castle, Ind.

Squires Co., C. E., Cleveland, O.

Watson & McDaniel Co., 146 N. Seventh St.,

Philadelphia, Pa.

Webster & Co., Warren, Camden, N. J. *See**pages 80, 81, 82, 83*

Williams Gauge Co., 543 Fourth Ave., Pitts-

burgh, Pa.

Ziermore Valve Co., Johnsonburg, Pa.

Steam Turbine*Pickering Governor Co., Portland, Conn. *See**page 131***Water Wheel**

Lombard Governor Co., Ashland, Mass.

Woodward Governor Co., Rockford, Ill.

GRADERS, ROAD (Rotary)

Mayer Bro. Co., Mankato, Minn.

GRADUATING MACHINESModern Tool Co., Erie, Pa. *See page 244***GRAIN CLEANING MACHINERY**

American Machinery & Construction Co.,

Milwaukee, Wis.

Barnard & Seas Mfg. Co., Moline, Ill.

GRAIN ELEVATOR EQUIPMENT

Union Iron Works, Decatur, Ill.

GRAPHITE

Acheson Graphite Co., Niagara Falls, N. Y.

Obermayer Co., S., *2563 W. 18th St., Chicago,

Ill.

Boiler

American Graphite Co. of Philadelphia, Land

Title Bldg., Philadelphia, Pa.

Arrow Boiler Compound Co., 703-715 Roe

Bldg., St. Louis, Mo.

Columbia Graphite Co., Cleveland, O.

Kelly Graphite Mills, 534 W. 22nd St., New

York, N. Y.

United States Graphite Co., Saginaw, Mich.

Flake (Lubricating)

Ashbury Graphite Mills, Ashbury, N. Y.

United States Graphite Co., Saginaw, Mich.

GRATE BARS

Bass Foundry & Machine Co., Fort Wayne

Ind. *See page 39*

Beach Mfg. Co., Charlotte, Mich.

Budd Grate & Foundry Co., 2013 E. Lehigh

St., Philadelphia, Pa.

Canton Grate Co., 1708 Woodland Ave. Can-

ton, O. *See page 71*Casey-Hedges Co., Chattanooga, Tenn. *See**pages 42, 43*Coe Co., C. T., 10-14 Johnson St., ~~St. Louis~~

N. J.

*Combustion Engineering Corp'n, 11 Broadway,

New York, N. Y.

*Erie City Iron Works, Erie, Pa. *See page 11*Godfrey-Keeler Co., 70 Warren St., ~~St. Louis~~

N. Y.

Grate Bar Co., Thomas, Birmingham, Ala.

Houston, Stanwood & Gamble Co., ~~St. Louis~~O. *See pages 46, 47*Kelly Foundry & Machine Co., ~~St. Louis~~

Goshen, Ind.

Keystone Stoker Co., Greenfield, Mass.

Kramer Bros. Foundry Co., ~~St. Louis~~McNaughton Mfg. Co., ~~St. Louis~~Marion Machine Foundry & ~~St. Louis~~

Marion, Ind.

Marshall Foundry Co., ~~St. Louis~~Pittsburgh, Pa. *See page 11*Martin Grate Co., ~~St. Louis~~Murray Iron Works Co., ~~St. Louis~~*page 16*Myerstown Foundry Co., ~~St. Louis~~West St., New ~~St. Louis~~Neemes Bros., ~~St. Louis~~New England ~~St. Louis~~

Mass.

St. John Grate Co., ~~St. Louis~~

Philadelphia, Pa.

Thompson & Co., ~~St. Louis~~

New York

U. S. Rocking Co., ~~St. Louis~~

St., Chicago

See Catalogue Section for data of firms listed in alphabetical order

GRATE BARS (continued)

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

GRATE SHAKERS, POWER (Locomotive)

Franklin Railway Supply Co., 30 Church St., New York, N. Y.

GRATES**Dumping**

Canton Grate Co., 1708 Woodland Ave., Canton, O. *See page 71*

Cyclone Grate Bar Co., Buffalo, N. Y.

Frost Mfg. Co., Galesburg, Ill.

Grate Bar Co., Thomas, Birmingham, Ala.

Kramer Bros. Foundry Co., Dayton, O.

Martin Grate Co., Chicago, Ill.

Murray Iron Works Co., Burlington, Ia. *See page 16*

New England Roller Grate Co., Springfield, Mass.

Thatcher & Co., Geo. H., Albany, N. Y.

Treadwell Co., M. H., 140 Cedar St., New York, N. Y.

Vasil Steam Systems Co., Hudson, Mass. *See page 63*

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Kila

Canton Grate Co., 1708 Woodland Ave., Canton, O. *See page 71*

Shaking

Budd Grate & Foundry Co., 2013 E Letterly St., Philadelphia, Pa.

Canton Grate Co., 1708 Woodland Ave., Canton, O. *See page 71*

Casey-Hedges Co., Chattanooga, Tenn. *See pages 42, 43*

Chicago Tile Arch Furnace Co., 321-323 W. Austin Ave., Chicago, Ill.

Cyclone Grate Bar Co., Buffalo, N. Y.

*Erie City Iron Works, Erie, Pa. *See page 12*

Frost Mfg. Co., Galesburg, Ill.

Grate Bar Co., Thomas, Birmingham, Ala.

Herrick, Geo. S., Syracuse, N. Y.

Kelly Foundry & Machine Co., E. Purl St., Goshen, Ind.

Kramer Bros. Foundry Co., Dayton, O.

McClave-Brooks Co., Scranton, Pa.

Marion Machine Foundry & Supply Co., Marion, Ind.

Martin Grate Co., Chicago, Ill.

Murray Iron Works Co., Burlington, Ia. *See page 16*

Necmes Bros., 206-216 First St., Troy, N. Y.

New England Roller Grate Co., Springfield, Mass.

Power Efficiency Corp'n, White Bldg., Buffalo, N. Y.

Power Engineering Co., Railway Exchange, Chicago, Ill.

Reagan Grate Bar Co., 209 N. Front St., Philadelphia, Pa.

*Springfield Boiler & Mfg. Co., Springfield, Ill. *See page 54*

St. John Grate Bar Co., The Bourse, Philadelphia, Pa.

Superior Iron Works Co., Superior, Wis.

Thatcher & Co., Geo. H., Albany, N. Y.

Twin Fire Furnace Co., 38 S. Dearborn St., Chicago, Ill.

U. S. Rocking Grate Bar Co., 20 W. Jackson St., Chicago, Ill.

Vasil Steam Systems Co., Hudson, Mass. *See page 63*

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Traveling

Chicago Tile Arch Furnace Co., 321-323 W. Austin Ave., Chicago, Ill.

Coxe Traveling Grate Co., 908 Markle Bank Bldg., Hazleton, Pa.

Water Tube

Swan, John F., 10th & Duncannon Sts., Philadelphia, Pa.

GRAVEL SCREENING PLANTS

Good Roads Machinery Co., Fort Wayne, Ind.

GREASE

Albany Lubricating Co., 708-710 Washington St., New York, N. Y. *See page 123*

Borne, Scrymser Co., 80 South St., New York, N. Y.

Dearborn Chemical Co., McCormick Bldg., Chicago, Ill.

Eagle Oil & Supply Co., 44-46 India St., Boston, Mass.

Harris Oil Co., A. W., 326 South Water St., Providence, R. I.

Keystone Lubricating Co., Philadelphia, Pa.

Moore Oil Co., Cincinnati, O.

New York & New Jersey Lubricant Co., 165 Broadway, New York, N. Y.

Philadelphia Grease Mfg. Co., 848-50 S. Swanson St., Philadelphia, Pa.

Platt & Washburn Refining Co., 11 Broadway, New York, N. Y.

Robinson & Son Co., Wm. C., 32 South St., Baltimore, Md.

*Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*

Standard Oil Co. of New York, 26 Broadway, New York, N. Y.

Stuart & Co., Inc., D. A., 29 S. LaSalle St., Chicago, Ill.

*Texas Co., 17 Battery Pl., New York, N. Y. *See page 124*

White Star Refining Co., 614-48 Avery Ave., Detroit, Mich.

Wolverine Lubricants Co. of New York, 80 Broad St., New York, N. Y.

Graphite

Kelly Graphite Mills, 534 W. 22nd St., New York, N. Y.

GRINDERS**Bench**

Forbes & Myers, Worcester, Mass.

St. Louis Machine Tool Co., 2607 S. Broadway, St. Louis, Mo.

Chaser

Modern Tool Co., Erie, Pa. *See page 244*

Feed

Gade Bros. Mfg. Co., Iowa Falls, Ia.

Lancaster Machine & Knife Works, Lancaster, N. Y.

Star Mfg. Co., New Lexington, O.

Floor

Hisey-Wolf Machine Co., Colerain & Marshall, Cincinnati, O.

St. Louis Machine Tool Co., 2607 S. Broadway, St. Louis, Mo.

Knife (Wood-Working)

Stockbridge Machine Co., Worcester, Mass.

Portable (Electric)

Electro Magnetic Tool Co., 2902 Canoll Ave., Chicago, Ill.

Hisey-Wolf Machine Co., Colerain & Marshall, Cincinnati, O.

Neil & Smith Electric Tool Co., 120-2 E. 8th St., Cincinnati, O.

Standard Electric Tool Co., Cincinnati, O.

Van Dorn Electric Tool Co., Cleveland, O. *See page 141*

Portable (Flexible Shaft)

Coates Clifton Mfg. Co., Worcester, Mass.

Webb Mfg. Co., Foot of Centre St., Newark, N. J.

Portable (Pneumatic)

Helwig Mfg. Co., St. Paul, Minn.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Saw

Espen-Lucas Machine Works, Front St. & Girard Ave., Philadelphia, Pa.

Gra

Higley Machine Co., Singer Bldg., New York, N. Y.
Hunter Saw & Machine Co., 57th & Butler Sts., Pittsburgh, Pa.

Tool

Barcalo Mfg. Co., Buffalo, N. Y.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Challenge Machine Co., Inc., 5118 Springfield Ave., Philadelphia, Pa.
Forbes & Myers, Worcester, Mass.
Gisholt Machine Co., Madison, Wis.
Pittsburgh Grinding Wheel Co., Rochester, Pa.
Ransom Mfg. Co., Oshkosh, Wis.
Springfield Mfg. Co., Bridgeport, Conn.

Twist Drill

La Salle Machine & Tool Co., 541 Second St., La Salle, Ill.
Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.
Wilmarth & Morman Co., Grand Rapids, Mich.

Wood Pulp

Carthage Machine Co., Carthage, N. Y.

GRINDING COMPOUND, VALVE

Carborundum Co., Niagara Falls, N. Y. *See page 248*
Norton Co., Worcester, Mass. *See page 249*

GRINDING MACHINERY

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*
Holmes & Blanchard Co., 31 State St., Boston, Mass.
Patterson Foundry & Machine Co., East Liverpool, O.
Raymond Bros. Impact Pulverizer Co., 1319 N. Branch St., Chicago, Ill.
Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

Wood

Mitts & Merrill, 816 S. Franklin St., Saginaw, Mich.

GRINDING AND SCREEN SEPARATION MACHINERY

Stroud & Co., E. R., 928-934 Fullerton Ave., Chicago, Ill.

GRINDING MACHINES**Ball Race**

Landis Tool Co., Waynesboro, Pa. *See page 243*
Van Norman Machine Tool Co., Springfield, Mass.

Cam

Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.

Car Wheel

Norton Grinding Co., Worcester, Mass.

Chuckling

Bryant Chucking Grinder Co., Springfield, Vt.

Crank Shaft

Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.
Landis Tool Co., Waynesboro, Pa. *See page 243*

Cutlery

Hemming Bros. Co., Inc., New Haven, Conn.

Cutter and Reamer

Baird Machine Co., Bridgeport, Conn.
Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.
Cincinnati Milling Machine Co., Cincinnati, O.
Greenfield Machine Co., Greenfield, Mass.
*Le Blond Machine Tool Co., R. K., Cincinnati, O.
Matson Machine Co., Concord, N. H.

Nutter & Barnes Co., Hinsdale, N. H.
Oesterlein Machine Co., Cincinnati, O.
Springfield Mfg. Co., Bridgeport, Conn.
Woods Engineering Co., 108 Patterson St., Alliance, O.

Cylindrical

Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.
Greenfield Machine Co., Greenfield, Mass.
Landis Tool Co., Waynesboro, Pa. *See page 243*
Modern Tool Co., Erie, Pa. *See page 244*
Norton Grinding Co., Worcester, Mass.
Queen City Machine Tool Co., 1405 Sycamore St., Cincinnati, O.

Disc

Diamond Machine Co., 9 Coddling St., Providence, R. I.

Hole and Face

Bryant Chucking Grinder Co., Springfield, Vt.

Internal

Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.
*Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa. *See page 243*
Modern Tool Co., Erie, Pa. *See page 244*
Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
Van Norman Machine Tool Co., Springfield, Mass.

Piston

Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.

Roll

Landis Tool Co., Waynesboro, Pa. *See page 243*
Norton Grinding Co., Worcester, Mass.

Surface

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.
Cleveland Planer Works, 3148 Superior Ave., Cleveland, O.
Diamond Machine Co., 9 Coddling St., Providence, R. I.
Garrigus Machine Co., C. G., Bristol, Conn.
*Heald Machine Co., Worcester, Mass.
La Salle Machine & Tool Co., 541 Second St., La Salle, Ill.
Norton Grinding Co., Worcester, Mass.
Persons-Arter Machine Co., 72 Commercial St., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Springfield Mfg. Co., Bridgeport, Conn.
Walker Co., O. S., Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Universal

Blake & Johnson Co., Waterbury, Conn. *See page 235*
Cincinnati Grinder Co., 1305 Bates Ave., Cincinnati, O.
Fitchburg Steam Engine Co., Fitchburg, Mass. *See page 13*
Greenfield Machine Co., Greenfield, Mass.
Landis Tool Co., Waynesboro, Pa. *See page 243*
Modern Tool Co., Erie, Pa. *See page 244*
Norton Grinding Co., Worcester, Mass.
Oesterlein Machine Co., Cincinnati, O.
Universal Grinding Machine Co., Fitchburg, Mass.
Valley City Machine Works, 12-16 Campau Ave., Grand Rapids, Mich.
Walker Co., O. S., Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.
Woods Engineering Co., 108 Patterson St., Alliance, O.

Gri

See Catalogue Section for data of firms listed in bold face type

GRINDING PANS

(See Pans, Grinding)

GRINDING WHEELSAbrasive Co., Bridesburg, Philadelphia, Pa.
American Emery Wheel Works, Providence, R. I.Bay State Emery Wheel Co., Worcester, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.Carborundum Co., Niagara Falls, N. Y. *See page 248*

Chicago Wheel & Mfg. Co., 1101-1103 W. Monroe St., Chicago, Ill.

Commercial Corundum & Emery Wheel Co., 920-922 W. Ohio St., Chicago, Ill.

Detroit Grinding Wheel Co., Detroit, Mich.

National Grinding Wheel Co., Inc., 2984 Main St., Buffalo, N. Y.

Norton Co., Worcester, Mass. *See page 249*

Peninsular Emery Wheel Co., 253 Meldrum Ave., Detroit, Mich.

Pittsburgh Grinding Wheel Co., Rochester, Pa.

Safety Emery Wheel Co., Springfield, O.

Star Corundum Wheel Co., Detroit, Mich.

Superior Corundum Wheel Co., Waltham, Mass.

Vitrified Wheel Co., Westfield, Mass.

Waltham Grinding Wheel Co., Waltham, Mass.

AlundumNorton Co., Worcester, Mass. *See page 249***Bauxite Carborundum**

Detroit Grinding Wheel Co., Detroit, Mich.

Carbolite

American Emery Wheel Works, Providence, R. I.

CrystolonNorton Co., Worcester, Mass. *See page 249***Elastic**

Bay State Emery Wheel Co., Worcester, Mass.

Norton Co., Worcester, Mass. *See page 249*

Ramsdell Specialty Co., 679 W. Boylston St., Worcester, Mass.

Waltham Grinding Wheel Co., Waltham, Mass.

Flexible

Divine Bros. Co., Utica, N. Y.

GRINDING WHEEL DRESSERS

Calder, Geo. H., Lancaster, Pa.

Challenge Machine Co., Inc., 5118 Springfield Ave., Philadelphia, Pa.

Desmond-Stephan Mfg. Co., Urbana, O.

Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

Norton Co., Worcester, Mass. *See page 249***GUN AND PROJECTILE MAKING MACHINERY**

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

GUN METAL FINISH

American Metal Treatment Co., Elizabeth, N. J.

H**HACK SAW BLADES**

(See Saw Blades, Hack)

HAMMERS**Drop***Alliance Machine Co., Alliance, O. *See page 188*Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Chambersburg Engineering Co., Chambersburg, Pa.

Cleveland Machine & Mfg. Co., 4938-4952 Hamilton Ave., Cleveland, O.

Long & Allstatter Co., Hamilton, O. *See page 213*

Massillon Foundry & Machine Co., Massillon, O.

Merrill Bros., Maspeth (Queens Borough), New York, N. Y.

Miner & Peck Mfg. Co., New Haven, Conn.

Standard Machinery Co., Auburn, R. I.

Toledo Machine & Tool Co., Toledo, O.

Williams, White & Co., Moline, Ill. *See page 215***Drop (Automatic)**

Miner & Peck Mfg. Co., New Haven, Conn.

Pneumatic

Helwig Mfg. Co., St. Paul, Minn.

Independent Pneumatic Tool Co., 1307 Michigan Ave., Chicago, Ill.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Nazel Engineering & Machine Works, 4041 N. 5th St., Philadelphia, Pa.

Power

Beaudry & Co., Inc., 141 Milk St., Boston, Mass.

Bellefonte Engineering Co., Bellefonte, Pa.

Bradley & Son, Inc., C. C., Syracuse, N. Y. *See page 216*

Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

Justice & Co., Philip S., 421 Chestnut St., Philadelphia, Pa.

Long & Allstatter Co., Hamilton, O. *See page 213*

Mayer Bro. Co., Mankato, Minn.

Nazel Engineering & Machine Works, 4041 N. 5th St., Philadelphia, Pa.

Novelty Iron Works Co., Dyersville, Ia.

Scranton & Co., New Haven, Conn.

Smith, H. Collier, 805-815 Scotten Ave., Detroit, Mich.

Williams, White & Co., Moline, Ill. *See page 215***Riveting and Chipping**

Cleveland Pneumatic Tool Co., 6410 Hawthorne Ave., Cleveland, O.

Dayton Pneumatic Tool Co., Dayton, O.

Electro Magnetic Tool Co., 2902 Canoll Ave., Chicago, Ill.

Independent Pneumatic Tool Co., 1307 Michigan Ave., Chicago, Ill.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Oldham & Son Co., Geo., 4316 Tackawanna St., Frankford, Philadelphia, Pa.

Rotary Riveting

High Speed Hammer Co., Rochester, N. Y.

Williams, White & Co., Moline, Ill. *See page 215***Steam***Alliance Machine Co., Alliance, O. *See page 188*

Chambersburg Engineering Co., Chambersburg, Pa.

Cleveland Machine & Mfg. Co., 4938-4952 Hamilton Ave., Cleveland, O.

Massillon Foundry & Machine Co., Massillon, O.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Steam (Double Frame)

Massillon Foundry & Machine Co., Massillon, O.

HANDLES, MACHINE (Steel)Cincinnati Ball Crank Co., Cincinnati, O. *See page 254***HANGERS, PIPE***Crane Co., 836 Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91***Shaft**

Bond Foundry & Machine Co., Manheim, Lancaster Co., Pa.

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136**Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

Gri

- *Chain Belt Co., 734 Park St., Milwaukee, Wis.
See pages 176, 177
- Dodge Sales & Engineering Co., Mishawaka, Ind.
See pages 74, 144, 145, 146, 147
- *Falls Clutch & Machinery Co., Cuyahoga Falls, O.
See page 143
- *Hill Clutch Co., Cleveland, O.
See page 148
- Hodson, G. & A., 226 Arch St., Philadelphia, Pa.
- Olney & Warren, 406-412 Broome St., New York, N. Y.
- Standard Pressed Steel Co., Philadelphia, Pa.
- Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill.
See pages 180, 181, 182
- *Wood's Sons Co., T. B., Chambersburg, Pa.
See page 150, 151

Shaft (Ball and Roller Bearing)

- *Fafnir Bearing Co., New Britain, Conn.
- Garney Ball Bearing Co., Jamestown, N. Y.
See page 155
- Hess-Bright Mfg. Co., Philadelphia, Pa.
See page 156
- New Departure Mfg. Co., Bristol, Conn.
See page 157
- *Royersford Foundry & Machine Co., 52 N. 6th St., Philadelphia, Pa.
See pages 152, 153
- S. K. F. Ball Bearing Co., Hartford, Conn.

HARDNESS MEASURING INSTRUMENTS
(See Instruments, Hardness Measuring)**HARDENING**

- American Metal Treatment Co., Elizabeth, N. J.

HARDWARE, PIANO

- Moore, George W., 44 Farnsworth St., Boston, Mass.

HEADERS**Bolt (Hand)**

- Brown Co., H. B., East Hampton, Conn.
Welded

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill.
See pages 88, 89, 90, 91
- Simmons Pipe Bending Works, 40 Mechanic St., Newark, N. J.

HEADING MACHINES (Cold)

- Cook Co., Asa S., Hartford, Conn.
- Manville Machine Co., E. J., Waterbury, Conn.

HEADING, UPSETTING AND FORGING MACHINES

- Williams, White & Co., Moline, Ill.
See page 215

HEADS, FLANGED AND DISHED

- Central Iron & Steel Co., Harrisburg, Pa.
- Glasgow Iron Co., Pottstown, Pa.
See page 60
- Lukens Iron & Steel Co., Coatesville, Pa.
See page 61

HEAT TREATING

- American Highspeed Chain Co., 401 S. Illinois St., Indianapolis, Ind.
- American Metal Treatment Co., Elizabeth, N. J.
- Ball & Roller Bearing Co., Maple Ave., Danbury, Conn.
- Connecticut Metal Treating, 207 Knowlton St., Bridgeport, Conn.
- Meisel Press Mfg. Co., 950 Dorchester Ave., Boston, Mass.

HEATERS**Asphalt**

- Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y.
See page 196

Domestic Water

- Griscom-Russell Co., 90 West St., New York, N. Y.
- Kelly & Son, Benj. F., 25 Church St., New York, N. Y.
- *National Pipe Bending Co., New Haven, Conn.
See pages 78, 79
- Stewart Heater Co., 391 Norfolk Ave., Buffalo, N. Y.

- Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Closed)

- Alberger Heater Co., 285 Chicago St., Buffalo, N. Y.
- Alberger Pump & Condenser Co., 140 Cedar St., New York, N. Y.
- Baragwanath & Son, Wm., 1260 W. Division St., Chicago, Ill.
- Berry Engineering Co., Chester, Pa.
- Canton Grate Co., 1708 Woodland Ave., Canton, O.
See page 71
- Cartwright-Caps Co., 1240 Transportation Bldg., Chicago, Ill.
- *Erie City Iron Works, Erie, Pa.
See page 12
- Griscom-Russell Co., 90 West St., New York, N. Y.
- Houston, Stanwood & Gamble Co., Cincinnati, O.
See pages 46, 47
- Jacobs & Co., Charles, 258 Franklin St., Boston, Mass.
- Kelly & Son, Benj. F., 25 Church St., New York, N. Y.
- Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y.
See page 110
- Murray Iron Works Co., Burlington, Ia.
See page 16
- *National Pipe Bending Co., New Haven, Conn.
See pages 78, 79
- Platt Iron Works, Dayton, O.
See page 290
- Ross Heater & Mfg. Co., Inc., 753 Bird Ave., Buffalo, N. Y.
- Standard Steam Specialty Co., 542-544 West Broadway, New York, N. Y.
- Standard Water Systems Co., Hampton, N. J.
- Stewart Heater Co., 391 Norfolk Ave., Buffalo, N. Y.
- Sims Co., Erie, Pa.
- Williams Tool Co., Erie, Pa.
- Wheeler Mfg. Co., C. H., Philadelphia, Pa.
See page 85
- Whitlock Coil Pipe Co., Hartford, Conn.
- Worthington Pump & Mch. Corp'n (Mack-Knowles Works), 115 Broadway, New York, N. Y.
See pages 26, 86, 276, 291

Feed Water (Locomotive)

- Locomotive Feed Water Heater Co., 20 Church St., New York, N. Y.

Glue

- *General Electric Co., Schenectady, N. Y.
See pages 30, 31
- Pancoast Co., Henry B., 243 & 245 S. 2nd St., Philadelphia, Pa.

Juice (Tabular)

- Murphy Iron Works, John H. & Co., New Orleans, La.

Oil

- Anthony Co., 138 West Ave., New York, N. Y.
See page 264

HEATERS AND PURIFIERS

- Bass Foundry & Machine Co., New York, Ind.
See page 39
- Booth Co., L. M., 62 H...
N. J.
- Canton Grate Co., 1708 Woodland Ave., Canton, O.
See page 71
- Colles Heater & Specialty Co., 1200 Madison Blvd., Chicago, Ill.
- Cookson Steam Specialty Co., 1200 Madison Ave., Cincinnati, O.
- Elliott Co., 6915 ...
Pa.
- Griscom-Russell Co., 90 West St., New York, N. Y.
- Harrison Safety ...
St., Philad...
- Hoppes Mfg. Co., ...
S. 37th St.
- Loomis Mfg. Co., ...
Mechanical ...
St., New ...
Milwaukee ...
Wis.

See Catalogue Section for data of firms listed in this section

HEATERS AND PURIFIERS, FEED WATER
(continued)

- Murray Iron Works Co., Burlington, Ia. *See page 16*
 *National Pipe Bending Co., New Haven, Conn. *See pages 78, 79*
 Open Coil Heater & Purifier Co., Indianapolis, Ind.
 Perfection Heater & Purifier Co., Milwaukee, Wis.
 Platt Iron Works, Dayton, O. *See page 290*
 Power Plant Specialty Co., 1306 Monadnock, Chicago, Ill.
 Ross Mfg. Co., Northville, Mich.
 Sims Co., Erie, Pa.
 *Springfield Boiler & Mfg. Co., Springfield, Ill. *See page 54*
 Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*
 *Wickes Boiler Co., Saginaw, Mich. *See page 57*
 Worthington Pump & Mch'y. Corp'n (Blake-Knowles Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Metering

- Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. *See pages 76, 77*
 Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

HEATING DEVICES, INDUSTRIAL (Electric)

- *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Simplex Electric Heating Co., 85 Sidney St., Cambridge, Mass.

HEATING MACHINES

- American Gas Furnace Co., 24 John St., New York, N. Y.

HEATING SYSTEMS**Air Return**

- Peerless Engineering Co., 1253-38 S. Dearborn St., Chicago, Ill.
 Positive Differential System Co., 132 Nassau St., New York, N. Y.

Exhaust Steam

- American District Steam Co., North Tonawanda, N. Y. *See page 118*

Gas

- Selas Co., 521 W. 23rd St., New York, N. Y. *See page 267*

Steam

- Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.

Vacuum

- Bishop-Babcock-Becker Co., Cleveland, O.
 Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*
 Illinois Engineering Co., 5021-7 S. State St., Chicago, Ill.
 Monash-Younger Co., 1407 W. Jackson Blvd., Chicago, Ill.
 Positive Differential System Co., 132 Nassau St., New York, N. Y.
 Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

HEATING AND VENTILATING APPARATUS

- American Blower Co., Detroit, Mich. *See pages 280, 281*
 Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
 Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*
 Gurney Heater Mfg. Co., 200 Franklin St., Boston, Mass.
 *Smith Co., H. B., Westfield, Mass. *See pages 308, 309*
 Sturtevant Co., B. F., Hyde Park, Boston, Mass.
 Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

HERRINGBONE GEARS

(See Gears, Herringbone)

HICKORY PRODUCTS

- Minton & Son, T. W., Barboursville, Ky.

HINGE MACHINES

- Baird Machine Co., Bridgeport, Conn.

HINGES, BRASS

- Root Co., C. J., 150 Bridge St., Bristol, Conn. *See page 340*

HOISTING ENGINES

(See Engines, Hoisting)

HOISTING MACHINERY

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
 Crandall Engineering Co., 102 Border St., East Boston, Mass.
 Eric Clutch & Pulley Co., 1906 Holland St., Erie, Pa.
 Haisa Mfg. Co., Geo., 141st St. & Rider Ave., New York, N. Y.
 *Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
 *Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
 *Link-Belt Co., Chicago, Ill. *See page 178*
 Potter Mfg. Co., 3511 E. Washington St., Indianapolis, Ind.
 *Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. *See page 192*
 Williams Co., C. H., Erie, Pa.

HOISTING OUTFITS

- Novo Engine Co., Lansing, Mich.

HOISTING PEDESTALS

- Coldwell-Wilcox Co., Newburgh, N. Y.

HOISTS**Air**

- Bridgeport Engineering Co., Bridgeport, Conn.
 Curtis Pneumatic Machinery Co., St. Louis, Mo.
 Dake Engine Co., Grand Haven, Mich.
 Detroit Hoist & Machine Co., Detroit, Mich.
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 *Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
 Miles Co., George, Winsted, Conn.
 *Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. *See page 192*
 Weir & Craig Mfg. Co., 2437 Wallace St., Chicago, Ill.

Ammunition

- Reading Chain Block Co., Reading, Pa.

Belt

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
 *Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Cargo (Electric)

- Maine Electric Co., 35 Commercial St., Portland, Me.

Chain

- Chisholm-Moore Mfg. Co., Cleveland, O.
 *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
 *Ford Chain Block & Mfg. Co., 139 W. Oxford St., Philadelphia, Pa. *See page 195*
 Franklin Moore Co., Winsted, Conn.
 Harrington, Son & Co., Inc., Edwin, 17th & Callowhill Sts., Philadelphia, Pa.
 *Link-Belt Co., Chicago, Ill. *See page 178*
 Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*
 New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*
 Reading Chain Block Co., Reading, Pa.
 Round & Son, D., Cleveland, O.
 Speidel, J. C., Reading, Pa.
 Wright Mfg. Co., Lisbon, O.
 Yale & Towne Mfg. Co., 9 E. 40th St., New York, N. Y.

Chain (Multiple Gear)

- *Ford Chain Block & Mfg. Co., 139 W. Oxford St., Philadelphia, Pa. *See page 195*

Hea

Reading Chain Block Co., Reading, Pa.
Coal (Electric)
Maine Electric Co., 35 Commercial St., Portland, Me.

Double Platform
Patten Mfg. Co., Chattanooga, Tenn.
Electric

*Alliance Machine Co., Alliance, O. *See page 188*

*Box & Co., Alfred, Philadelphia, Pa.

*Brown Hoisting Machinery Co., Cleveland, O.
Browning & Co., Victor R., 17701 Lake Shore Blvd., Cleveland, O.

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*

Detroit Hoist & Machine Co., Detroit, Mich.
Euclid Crane & Hoist Co., Euclid, O.

Flory Mfg. Co., S., Bangor, Pa.

Franklin Moore Co., Winsted, Conn.

*General Electric Co., Schenectady, N. Y.
See pages 30, 31

Gruendler Patent Crusher & Pulverizer Co., 928 N. First St., St. Louis, Mo.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

*Link-Belt Co., Chicago, Ill. *See page 178*
Maine Electric Co., 35 Commercial St., Portland, Me.

Maris Brothers, Philadelphia, Pa.

*Northern Engineering Works, Detroit, Mich.
Orr & Sembower, Inc., Reading, Pa.

Parker, S. E., 1800 N. Francisco Ave., Chicago, Ill.

Patten Mfg. Co., Chattanooga, Tenn.

Pawling & Harnischfeger Co., Milwaukee, Wis.

Pneumelectric Machine Co., Syracuse, N. Y.
Ricker Mfg. Co., 239 Water St., Rochester, N. Y.

Roeper Crane & Hoist Works, Reading, Pa.

*Sprague Electric Works, 527 W. 34th St., New York, N. Y.

*Shepard Electric Crane & Hoist Co., Mont-toro Falls, N. Y. *See page 192*

Stamp Co., Charles E., Cleveland, O.

Thomas Elevator Co., 20 S. Hoyne Ave., Chicago, Ill.

*Toledo Bridge & Crane Co., Toledo, O.

Weir & Craig Mfg. Co., 2437 Wallace St., Chicago, Ill.

Yale & Towne Mfg. Co., 9 E. 40th St., New York, N. Y.

Friction Drum

Dake Engine Co., Grand Haven, Mich.

O. K. Clutch & Machinery Co., Second & Linden Sts., Columbia, Pa.

Patten Mfg. Co., Chattanooga, Tenn.

Universal Hoist & Mfg. Co., Cedar Falls, Ia.

Gasoline

Brown Clutch Co., Sandusky, O.

Flory Mfg. Co., S., Bangor, Pa.

Ideal Engine Co., Lansing, Mich.

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Parker, S. E., 1800 N. Francisco Ave., Chicago, Ill.

Patten Mfg. Co., Chattanooga, Tenn.

Thomas Elevator Co., 20 S. Hoyne Ave., Chicago, Ill.

Universal Hoist & Mfg. Co., Cedar Falls, Ia.

Gate

Hunt Machine Co., Rodney, Orange, Mass.

Smith Co., S. Morgan, York, Pa.

Hatchway

Sedgwick Machine Works, Inc., 128 W. Liberty St., New York, N. Y.

Mine

Flory Mfg. Co., S., Bangor, Pa.

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Ottumwa Iron Works, Ottumwa, Ia.

Sullivan, John N., Hickory & Mattes Sts., Scranton, Pa.

Skip

Beaumont, Co. R. H., Drexel Bldg., Philadelphia, Pa.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

Otis Elevator Co., 11th Ave. & 26th St., New York, N. Y.

Steam

(See Engines, Hoisting)

Truck Body

Meisel Press Mfg. Co., 950 Dorchester Ave., Boston, Mass.

HOLDERS

Gas

Bartlett Hayward Co., Baltimore, Md.

Koven & Brother, L. O. Jersey City, N. J. *See page 301*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Knurl

Graham Mfg. Co., Providence, R. I.

Tap and Die (Combination)

Ramsdell Specialty Co., 679 W. Boylston St., Worcester, Mass.

Tool

Ready Tool Co., Bridgeport, Conn.

Union Tool Co., Orange, Mass.

Western Tool & Mfg. Co., Springfield, O.

HOOKS, CHAIN

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

HONES

Norton Co., Worcester, Mass. *See page 249*

HOPPERS

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Weighing

Holmes & Bros., Rob't, Danville, Ill.

HOSE

Air

American Metal Hose Co., Waterbury, Conn. *See page 132*

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

*Goodrich Co., B. F., Akron, O. *See pages 133, 165*

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

*Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.

Cotton, Rubber Lined

Empire Rubber & Tire Co., Trenton, N. J.

Eureka Fire Hose Mfg. Co., 29 Barclay St., New York, N. Y.

Fabric Fire Hose Co., Cor. Duane & Church Sts., New York, N. Y.

McIlroy Belting & Hose Co., Hammond, Ind.

*Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.

Linen

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

Eureka Fire Hose Mfg. Co., 29 Barclay St., New York, N. Y.

*Goodrich Co., B. F., Akron, O. *See pages 133, 165*

Rossendale-Reddaway Belting & Hose Co., Newark, N. J. *See page 168*

Metal

American Brass Co., Waterbury, Conn. *See page 204*

American Metal Hose Co., Waterbury, Conn. *See page 132*

Hos

See Catalogue Section for data of firms listed in bold face type

HOSE (continued)

Metal

- ***Johns-Manville Co.**, H. W., 296 Madison Ave., New York, N. Y. *See page 119*
Kingsbridge Machine Works, Kingsbridge, New York, N. Y.
Pennsylvania Flexible Metallic Tubing Co., N. E. Cor. Broad & Race Sts., Philadelphia, Pa.
U. S. Flexible Metallic Tubing Co., 430 Boyd St., Los Angeles, Cal.

Metal, Flexible

- American Metal Hose Co.**, Waterbury, Conn. *See page 132*
 "Double Service" **Packing Co.**, 246 Chestnut St., Philadelphia, Pa.
Mulconroy Co., Inc., 54th & Jefferson Sts., Philadelphia, Pa.
United Metal Hose Co., Inc., 510 W. 24th St., New York, N. Y.

Metal, Flexible and Armored

- United Metal Hose Co., Inc.**, 510 W. 24th St., New York, N. Y.

Oil

- American Metal Hose Co.**, Waterbury, Conn. *See page 132*
Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
Continental Rubber Works, Erie, Pa.

- ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*

Rubber

- Boston Belting Co.**, 84 Linden Park St., Boston, Mass. *See page 162*
Consolidated Rubber Co., P. O. Box 86, Trenton, N. J.

- ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*

- Mechanical Rubber Co.**, Cleveland, O. *See page 169*

- Mechanical Rubber Co.**, Chicago, Ill.

- Mercer Rubber Co.**, Hamilton Square, Trenton, N. J.

- New York Belting & Packing Co.**, 91-93 Chambers St., New York, N. Y.

- New York Rubber Co.**, 84-86 Reade St., New York, N. Y.

- Pearless Rubber Mfg. Co.**, 31 Warren St., New York, N. Y.

- Pennsylvania Rubber Co.**, Jeannette, Pa.

- ***Quaker City Rubber Co.**, 629 Market St., Philadelphia, Pa.

- Republic Rubber Co.**, Youngstown, O.

- Revere Rubber Co.**, Chelsea, Mass.

- Revere Rubber Co.**, 59 Reade St., New York, N. Y.

- Voorhees Rubber Mfg. Co.**, 18-56 Bostwick Ave., Jersey City, N. J.

Steam

- American Metal Hose Co.**, Waterbury, Conn. *See page 132*

- Boston Belting Co.**, 84 Linden Park St., Boston, Mass. *See page 162*

- Boston Woven Hose & Rubber Co.**, Box 5077, Boston, Mass.

- Continental Rubber Works**, Erie, Pa.

- ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*

- ***Ingersoll-Rand Co.**, 11 Broadway, New York, N. Y. *See pages 272, 273*

- New Jersey Car Spring & Rubber Co.**, Jersey City, N. J.

- ***Quaker City Rubber Co.**, 629 Market St., Philadelphia, Pa.

- United Metal Hose Co., Inc.**, 510 W. 24th St., New York, N. Y.

Suction

- American Metal Hose Co.**, Waterbury, Conn. *See page 132*

- Boston Belting Co.**, 84 Linden Park St., Boston, Mass. *See page 162*

- ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*

- ***Quaker City Rubber Co.**, 629 Market St., Philadelphia, Pa.

- United Metal Hose Co., Inc.**, 510 W. 24th St., New York, N. Y.

HOSE ATTACHMENTS (Couplings, Bands, Holders, Clamps, etc.)

- Cladfin Co.**, C. A., 181 High St., Boston, Mass.

- Fabric Fire Hose Co.**, Cor. Duane & Church Sts., New York, N. Y.

- ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*

- ***Ingersoll-Rand Co.**, 11 Broadway, New York, N. Y. *See pages 272, 273*

- Mulconroy Co., Inc.**, 54th & Jefferson Sts., Philadelphia, Pa.

- National Brake & Electric Co.**, Milwaukee, Wis. *See pages 278, 279*

HUMIDIFIERS

- Carrier Air Conditioning Co.**, 490 Broadway, Buffalo, N. Y.

- Carrier Engineering Corp'n**, 39 Cortlandt St., New York, N. Y.

- Dicks, Slosson Co., Inc.**, 302 Broadway, New York, N. Y.

- Greeff Engineering & Mfg. Co.**, 36 Spring St., Newark, N. J.

- Parks Co.**, G. M., Fitchburg, Mass.

- Tillotson Humidifier Co.**, Providence, R. I.

- Webster & Co.**, Warren, Camden, N. J. *See pages 80, 81, 82, 83*

HUMIDITY CONTROL

- Carrier Engineering Corp'n**, 39 Cortlandt St., New York, N. Y.

- Richmond Engineering Co.**, 12 S. 8th St., Richmond, Va.

- Webster & Co.**, Warren, Camden, N. J. *See pages 80, 81, 82, 83*

HYDRANT HEADS, PORTABLE

- Ross Valve Mfg. Co.**, Troy, N. Y.

HYDRANTS, FIRE

- Chapman Valve Mfg. Co.**, Indian Orchard, Mass.

- Darling Pump & Mfg. Co., Ltd.**, Williamsport, Pa. *See page 92*

- Eddy Valve Co.**, Waterford, N. Y.

- Kennedy Valve Mfg. Co.**, 1100 E. Water St., Elmira, N. Y. *See page 98*

- ***Ludlow Valve Mfg. Co.**, Troy, N. Y.

- Norwood Engineering Co.**, Florence, Mass.

- Pratt & Cady Co., Inc.**, Hartford, Conn. *See pages 100, 101*

- Rensselaer Valve Co.**, Troy, N. Y.

- Smith Mfg. Co.**, A. P., East Orange, N. J.

- ***Wood & Co.**, R. D., Philadelphia, Pa. *See pages 294, 295*

- Worthington Pump & Mch. Corp'n** (Holly Mfg. Co.), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

HYDRATING PLANTS

- Steady-Schmidt Mfg. Co.**, York, Pa.

HYDRAULIC JACKS, RAMS, TURBINES, ETC.

- (See Jacks, Rams, Turbines, etc., Hydraulic)

HYDRAULIC MACHINERY

- ***Alliance Machine Co.**, Alliance, O. *See page 188*

- Burroughs Co.**, Charles, 141-149 Commerce St., Newark, N. J.

- Lake Erie Engineering Works**, Buffalo, N. Y.

- Logemann Brothers Co.**, Milwaukee, Wis.

- ***Morgan Engineering Co.**, Alliance, O.

- Southwark Foundry & Machine Co.**, Philadelphia, Pa. *See page 24*

- Treadwell Engineering Co.**, 140 Cedar St., New York, N. Y.

- Waterbury Farrel Foundry & Machine Co.**, Waterbury, Conn.

- Watson-Stillman Co.**, 50 Church St., New York, N. Y.

- ***Wood & Co.**, R. D., Philadelphia, Pa. *See pages 294, 295*

- Wood, Wm. H.**, Media, Pa.

Hos

HYDROMETERS

- American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*
 Berg Mfg. Co., James, 3707 12th Ave., Brooklyn, N. Y.
 Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*
 Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*
 *Taylor Instrument Cos., Rochester, N. Y. *See page 331*
 Wagner, Carl H., 1944 N. Albany Ave., Chicago, Ill.
- HYGROMETERS**
 *Bristol Co., Waterbury, Conn. *See page 327*
 Brown Instrument Co., Philadelphia, Pa. *See page 328*
 Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*
 *Taylor Instrument Cos., Rochester, N. Y. *See page 331*

I**I-BEAM TROLLEYS**

(See Trolleys, Mono-Rail)

ICE HANDLING MACHINERY

- *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 Gifford-Wood Co., Hudson, N. Y.

ICE MAKING MACHINERY

- Arctic Ice Machine Co., Canton, O.
 Armstrong Machinery Co., 3201-3210 East Riverside, Spokane, Wash.
 Automatic Refrigerating Co., Hartford, Conn.
 Baker Ice Machine Co., Omaha, Neb.
 Brunswick Refrigerating Co., New Brunswick, N. J.
 Buffalo Refrigerating Machine Co., 126 Liberty St., New York, N. Y.
 Carbondale Machine Co., Carbondale, Pa. *See page 307*
 Columbus Iron Works Co., Columbus, Ga.
 *De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*
 Frick Co., Waynesboro, Pa.
 Hallam, F. W., 80 Stanhope St., Brooklyn, N. Y.
 Harris Ice Machine Works, Inc., 174 E. Water St., Portland, Ore.
 Kroeschell Bros. Ice Machine Co., 472 W. Erie St., Chicago, Ill.
 Mayer Ice Machine & Engineering Co., Morris St. & Hudson River, Jersey City, N. J.
 National Foundry & Machine Co., 1406 W. Main St., Louisville, Ky.
 Niebling Co., F. W., Cincinnati, O.
 Phoenix Ice Machine Co., 2711 Church Ave., Cleveland, O.
 Remington Machine Co., Wilmington, Del.
 Ruemmeli-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.
 Triumph Electric & Ice Machine Co., Cincinnati, O.
 Triumph Ice Machine Co., Cincinnati, O.
 *Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*
 Vogt Machine Co., Henry, Louisville, Ky. *See page 55*
 York Mfg. Co., York, Pa.

ICE PLANT SUPPLIES

- Niebling Co., F. W., Cincinnati, O.
 Arctic Ice Machine Co., Canton, O.

IGNITION APPARATUS

- Accurate Engineering Co., Chicago, Ill.
 Bosch Magneto Co., 223-225 W. 46th St., New York, N. Y.
 Witherbee Igniter Co., Springfield, Mass.

IMPREGNATING APPARATUS

- Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*

INCINERATORS

- Decarie Incinerator Co., Minneapolis, Minn.
 Harris Municipal Garbage Incinerator & Steam Generator Co., 65 Life & Casualty Bldg., Nashville, Tenn.

- Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

INDICATOR FITTINGS AND SUPPLIES

- American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*

INDICATOR POSTS

- Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. *See page 92*
 Kennedy Valve Mfg. Co., 1100 E. Water Co., Elmira, N. Y. *See page 98*
 Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*
 Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*
 *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

INDICATORS**COs**

- *Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.
 Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. *See page 321*

Direction (Marine)

- McNab Co., Bridgeport, Conn.
 Engine (Continuous Card)

- Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*
 Trill Indicator Co., Corry, Pa.

Engine (Inside and Outside Spring)

- American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 Ashcroft Mfg. Co., 119 W. 40th St., New York, N. Y.
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*
 Thompson & Co., Richard, 126 Liberty St., New York, N. Y.
 Trill Indicator Co., Corry, Pa.

Pressure (Gas Engine)

- Loomis, O. P., Newport News, Va.

Sight Flow

- *Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*

Smoke

- Boiler Room Improvement Co., 184 N. Market St., Chicago, Ill.

Speed

- American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*
 Brown Instrument Co., Philadelphia, Pa. *See page 328*
 Electric Tachometer Corp'n, Perry Bldg., Philadelphia, Pa.
 McDonnell Odometer Co., 35th St. & Kedzie Ave., Chicago, Ill.
 Root Co., C. J., 150 Bridge St., Bristol, Conn. *See page 340*
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*
 *Veeder Mfg. Co., Hartford, Conn. *See page 341*
 *Weston Electrical Instrument Co., Waverly Park, Newark, N. J. *See page 333*

INDUSTRIAL RAILWAYS

(See Railways, Industrial)

INJECTORS

- American Injector Co., Detroit, Mich. *See page 116*
 Desmond-Stephan Mfg. Co., Urbana, O.
 Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

Inj

See Catalogue Section for data of firms listed in bold face type

INJECTORS (continued)

Ohio Injector Co., S. Main St., Wadsworth, O.
 Penberthy Injector Co., Detroit, Mich. *See page 117*
 Rue Mfg. Co., 228 Cherry St., Philadelphia, Pa.
 Sellers & Co., Inc., Wm., Philadelphia, Pa.
 Sherwood Mfg. Co., Buffalo, N. Y.
 Watson, N. A., 2016 State St., Erie, Pa.

INSERTS, CONCRETE

Diamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Star Expansion Bolt Co., 147-149 Cedar St., New York, N. Y.

INSTRUMENTS

Electrical Measuring

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*
 *Bristol Co., Waterbury, Conn. *See page 327*
 Brown Instrument Co., Philadelphia, Pa. *See page 328*
 Central Scientific Co., 460 E. Ohio St., Chicago, Ill.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Morse Thermo-Gage Co., Inc., Ithaca, N. Y.
 Pignolet, Louis M., 78 Cortlandt St., New York, N. Y.
 Queen-Gray Co., 616-620 Chestnut St., Philadelphia, Pa.
 Robert Instrument Co., 56 Shelby St., Detroit, Mich.
 Roller-Smith Co., 233 Broadway, New York, N. Y.
 *Taylor Instrument Cos., Rochester, N. Y. *See page 331*
 Thompson-Levering Co., 323 Arch St., Philadelphia, Pa.
 Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
 *Weston Electrical Instrument Co., Waverly Park, Newark, N. J. *See page 333*

Hardness Measuring

Holz, Herman A., 50 Church St., New York, N. Y.
 Shore Instrument & Mfg. Co., Inc., 557 W. 22nd St., New York, N. Y.

Recording

American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 *Bailey Meter Co., 141 Milk St., Boston, Mass. *See page 318*
 *Bristol Co., Waterbury, Conn. *See page 327*
 Brown Instrument Co., Philadelphia, Pa. *See page 328*
 Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass. *See page 324*
 DuViver, Ernest H., 30 Church St., New York, N. Y.
 Electric Tachometer Corp'n, Perry Bldg., Philadelphia, Pa.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Green, Henry J., 1191 Bedford Ave., Brooklyn, N. Y.
 Hydro Mfg. Co., 320 Bullitt Bldg., Philadelphia, Pa.
 *Precision Instrument Co., Detroit, Mich. *See page 320*
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*
 *Scientific Materials Co., 711-719 Forbes St., Pittsburgh, Pa.
 Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y. *See page 337*
 Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*
 Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*
 Uehling Instrument Co., 2011 Empire Bldg., New York, N. Y. *See page 321*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Scientific

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*
 Standard Scientific Co., 147-153 Waverly Place, New York, N. Y.
 *Taylor Instrument Cos., Rochester, N. Y. *See page 331*
 *Warner & Swasey Co., Cleveland, O. *See page 225*

Testing

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*
 Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

Testing (Optical)

Bausch & Lomb Optical Co., Rochester, N. Y.

INSULATING MACHINERY (Wire)

American Insulating Machinery Co., Inc., Fairhall & Huntington Sts., Philadelphia, Pa.
 New England Butt Co., Providence, R. I. *See page 304*
 Royle & Sons, John, Paterson, N. J.
 Textile Machine Works, Reading, Pa. *See page 305*

INSULATING MATERIALS

Electric

*American Vulcanized Fibre Co., Wilmington, Del. *See page 203*
 Consumers Rubber Co., 829 Superior Ave., W. Cleveland, O.
 D & W Fuse Co., Providence, R. I. *See page 253*
 Delaware Hard Fibre Co., Wilmington, Del.
 *Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
 Johns-Pratt Co., 555 Capitol Ave., Hartford, Conn.
 United States Asbestos Co., Fehl Bldg., Lancaster, Pa.

Heat and Cold

Armstrong Cork & Insulation Co., 122 24th St., Pittsburgh, Pa. *See page 120*
 Carey Co., Philip, Cincinnati, O. *See page 121*
 Ehret Magnesia Mfg. Co., Valley Forge, Pa. *See page 121*
 Franklin Mfg. Co., Franklin, Pa. *See page 121*
 *Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
 Keasbey & Mattison Co., Ambler, Pa. *See page 121*
 Standard Asbestos Mfg. Co., Chicago, Ill.
 Union Fibre Co., Winona, Minn.
 U. S. Mineral Wool Co., 280 Madison Ave., New York, N. Y.

IRON

Staybolt

Rome Merchant Iron Mill, 30 Church St., New York, N. Y.

Swedish

Swedish Iron & Steel Corp'n, 12 Platt St., New York, N. Y.

IRON WORK, ORNAMENTAL

(See Ornamental Work)

IRRIGATION MACHINERY

Charter Gas Engine Co., Sterling, Ill.

IRRIGATION SYSTEMS

*Spray Engineering Co., 93 Federal St., Boston, Mass. *See page 87*

Advertisements of firms marked * appear in The Journal, A. S. M. E.

JACKS**J****Car**

DeWeese Co., F. M., Chillicothe, O.
Hydraulic

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.
Duff Mfg. Co., Pittsburgh, Pa.
Gade Bros. Mfg. Co., Iowa Falls, Ia.
Joyce-Cridland Co., Dayton, O.
Justice & Co., Philip S., 421 Chestnut St., Philadelphia, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*
Stickney Co., Chas. A., St. Paul, Minn.
Watson-Stillman Co., 50 Church St., New York, N. Y.

Lifting

Air Device Mfg. Co., 5702 S. State St., Chicago, Ill.
DeWeese Co., F. M., Chillicothe, O.
Duff Mfg. Co., Pittsburgh, Pa.
Joyce-Cridland Co., Dayton, O.

Screw

Joyce-Cridland Co., Dayton, O.
Justice & Co., Philip S., 421 Chestnut St., Philadelphia, Pa.
Riehl Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

Track

DeWeese Co., F. M., Chillicothe, O.

JACQUARD CARD MACHINERY

Royle & Sons, John, Paterson, N. J.

JAWS, FACE PLATE (Portable)

Cushman Chuck Co., Hartford, Conn.

JETS, STEAM

(See Blowers, Steam Jet)

JIGS AND FIXTURES

Columbus Die, Tool & Machine Co., Columbus, O.
*Crowder Machine Works, C. H., Fitchburg, Mass. *See page 236*
Elgin Tool Works, Elgin, Ill.
Gisholt Machine Co., Madison, Wis.
Griswold Machine Co., George M., Cor. Bradley & William Sts., New Haven, Conn.
Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn. *See page 237*
Hartford Special Machinery Co., Hartford, Conn.
Marvin & Casler Co., Canastota, N. Y.
Mehl Machine, Tool & Die Co., Roselle, N. J. *See pages 238, 239*
Reynolds Pattern & Machine Co., 101-103 Third Ave., Moline, Ill.
Sheffield Machine & Tool Co., Dayton, O.
Sloan & Chase Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*
Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y. *See page 337*

JOINTS**Expansion**

American Brass Co., Waterbury, Conn. *See page 204*
Central Station Steam Co., 710 East Woodbridge St., Detroit, Mich.
*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
Direct Separator Co., Syracuse, N. Y.
Hornung, J. C., 343 S. Dearborn St., Chicago, Ill.
Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
Konold Co., J., 602 Bessemer Bldg., Pittsburgh, Pa.
*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
Ross Heater & Mfg. Co., Inc., 753 Bird Ave., Buffalo, N. Y.

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*
Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Flanged Pipe

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
Simmons Pipe Bending Works, 40 Mechanic St., Newark, N. J.

Flexible

Barco Brass & Joint Co., 212-222 W. Illinois St., Chicago, Ill.
Moran Flexible Steam Joint Co., 217 W. Main St., Louisville, Ky.
Walker Mfg. Co., Fenton, Mich.

Rail

Falk Co., Milwaukee, Wis. *See pages 138, 139*

Rail Joint Co., 61 Broadway, New York, N. Y.

Rail (Insulated)

Rail Joint Co., 61 Broadway, New York, N. Y.

Swing and Swivel

Barco Brass & Joint Co., 212-222 W. Illinois St., Chicago, Ill.
*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Universal

Baush Machine Tool Co., Springfield, Mass.
Burt Mfg. Co., Kalamazoo, Mich.
Eclipse Machine Co., Elmira, N. Y.

JOLT RAMMING MACHINES

(See Rammers, Foundry)

JOURNAL BOXES

Symington Co., T. H., 30 Church St., New York, N. Y.
Union Spring & Mfg. Co., 2408 First Nat'l Bank, Pittsburgh, Pa.

K**KETTLES**

Koven & Brother, L. O., Jersey City, N. J. *See page 301*
Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. *See page 50*

Steam-Jacketed

Buckeye Boiler Co., 1617 McLain St., Dayton, O.
Elyria Enameled Products Co., Elyria, O.
Sowers Mfg. Co., 1298-1310 Niagara St., Buffalo, N. Y.

Tar

Honhorst Co., Jos., Cincinnati, O.

Varnish (Welded)

American Welding Co., Carbondale, Pa.

KEYS, MACHINE

Leard, Wm. E., New Brighton, Pa.
Whitney Mfg. Co., Hartford, Conn.

KEYSEATING MACHINES

Baker Bros., Toledo, O.
Chattanooga Machinery Co., Chattanooga, Tenn.
Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.
Lapointe Machine Tool Co., Hudson, Mass.
Mitts & Merrill, 816 S. Franklin St., Saginaw, Mich.
Morton Mfg. Co., Miskegon Heights, Mich.
National Machine Tool Co., 2272 Spring Grove Ave., Cincinnati, O.

Key

See Catalogue Section for data of firms listed in bold face type

KIERS, BLEACH (Rotary)

Dillon Steam Boiler Works, D. M., Fitchburg, Mass.

KILNS

Cement

Sterrit-Thomas Foundry Co., 32nd & Smallman Sts., Pittsburgh, Pa.
United Iron Works Co., Iola, Kan.

Dry (Brick, Lumber, Stone, etc.)

American Blower Co., Detroit, Mich. *See pages 280, 281*

Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. *See page 297*

Ruggles-Coles Engineering Co., York, Pa.

Lime

Steady-Schmidt Mfg. Co., York, Pa.

Revivifying

Kent, Inc., Robert Sayre, 50 Court St., Brooklyn, N. Y.

KNIVES

Mixer

Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*

Squaring Shear

Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

L

LABORATORY APPARATUS

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*

Central Scientific Co., 460 E. Ohio St., Chicago, Ill.

Bimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

Hanovia Chemical & Mfg. Co., Chestnut St. & N. J. Railroad Ave., Newark, N. J.

Standard Scientific Co., 147-153 Waverly Place, New York, N. Y.

Thomas Co., Arthur H., W. Washington Sq., Philadelphia, Pa.

LABORATORY FURNITURE

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*

LABORATORY WARE

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*

Bimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

Norton Co., Worcester, Mass. *See page 249*

LACE LEATHER

Alexander Brothers, 414 N. 3rd St., Philadelphia, Pa.

Bonner & Barnewall, Inc., 30 Church St., New York, N. Y.

Central Belting Co., 151 Lafayette St., New York, N. Y.

Consolidated Belting Co., 2 Jeffrey St., Chester, Pa.

Cook Belting Co., H. N., San Francisco, Cal. *See page 163*

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

Holyoke Belting Co., Holyoke, Mass.

Hudson Belting Co., Worcester, Mass.

Jewell Belting Co., Hartford, Conn.

Ladew Co., Inc., Edward R., Glen Cove, N. Y.

National Leather Belting Co., 342 E. 38th St., New York, N. Y.

Norwich Belting Co., Norwich, Conn.

Olmsted-Flint Co., 624 Main St., Cambridge, Mass.

Rhoads & Sons, J. E., 12 N. Third St., Philadelphia, Pa.

*Schleren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*

Schwartz Belting Co., 76 Murray St., New York, N. Y.

Shultz Belting Co., St. Louis, Mo. *See page 171*

LACE TIPPERS

Franklin Machine Co., Providence, R. I.

LADLES

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Treadwell Construction Co., Midland, Pa.

LAMP BRACKETS, UNIVERSAL

McCrosky Reamer Co., Meadville, Pa. *See pages 246, 247*

LAMP GUARDS, ELECTRIC

*Flexible Steel Lacing Co., 322 S. Clinton St., Chicago, Ill. *See page 268*

LAMPS

Acetylene

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Incandescent

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Mine (Electric)

Edison Storage Battery Co., Orange, N. J.

LAND-CLEARING MACHINERY

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*

LATHE ATTACHMENTS

Acme Machine Tool Co., Cincinnati, O. *See page 218*

Cincinnati Lathe & Tool Co., 3207 North St., Oakley, Cincinnati, O.

Elgin Tool Works, Elgin, Ill.

LATHE DOGS, SAFETY

Sargent Co., Fisher Bldg., Chicago, Ill.

LATHES

American Tool Works Co., Cincinnati, O.

Duff Mfg. Co., Pittsburgh, Pa.

Fay & Scott, Dexter, Me.

*Harris-Corliss Engine & Machine Co., Providence, R. I. *See page 15*

Simplex Machine Tool Co., Hamilton, O.

Springfield Machine Tool Co., Springfield, O.

Superior Machine Tool Co., Kokomo, Ind.

Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

Automatic

*Jones & Lamson Machine Co., Springfield, Vt. *See pages 220, 221, 222, 223*

Awls

Bridgeford Machine Tool Works, 225 Mill St., Rochester, N. Y.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Bench

American Watch Tool Co., Waltham, Mass.

Hardinge Brothers, Inc., 1770 Breteau Ave., Chicago, Ill.

Sloan & Chace Mfg Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*

Bevel Gear Turning

Bridgeford Machine Tool Works, 225 Mill St., Rochester, N. Y.

Bobbin

Murkland Co., J. W., Barton, Vt.

Brass

Acme Machine Tool Co., Cincinnati, O. *See page 218*

American Tool & Machine Co., 109 Beach St., Boston, Mass.

Kie

Advertisements of firms marked * appear in The Journal, A. S. M. E.

***Warner & Swasey Co.,** Cleveland, O. *See page 225*

Brass Forming

Meriden Machine Tool Co., Meriden, Conn.

Chucking

Cleveland Automatic Machine Co., 2269 Ashland Road, Cleveland, O.

***Jones & Lamson Machine Co.,** Springfield, Vt. *See pages 220, 221, 222, 223*

Lodge & Shipley Machine Tool Co., 3055-65 Colerain Ave., Cincinnati, O.

Crankshaft

Lodge & Shipley Machine Tool Co., 3055-65 Colerain Ave., Cincinnati, O.

Engine

Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill.

Bradford Machine Tool Co., Cincinnati, O.

Bridgeford Machine Tool Works, 225 Mill St., Rochester, N. Y.

Bullard Machine Tool Co., Bridgeport, Conn.

Champion Tool Works, Cincinnati, O.

Cincinnati Lathe & Tool Co., 3207 North St., Oakley, Cincinnati, O.

Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Flather & Co., Inc., 29 Crown St., Nashua, N. H.

Greaves-Klusman Tool Co., Cincinnati, O.

Hamilton Machine Tool Co., Hamilton, O.

Hendey Machine Co., Torrington, Conn.

Johnson Jr. Co., Inc., I. H., 337 N. 15th St., Philadelphia, Pa.

***Le Blond Machine Tool Co.,** R. K., Cincinnati, O.

Leland Gifford Co., Worcester, Mass.

Lodge & Shipley Machine Tool Co., 3055-65 Colerain Ave., Cincinnati, O.

Mann, Charles A., 166 Doyle Ave., Providence, R. I.

Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York, N. Y.

Monarch Machine Tool Co., Sidney, O.

Morris Machine Tool Co., Court & Harriet Sts., Cincinnati, O.

Myers Machine Tool Co., Columbia, Pa.

New Haven Mfg. Co., New Haven, Conn.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Oliver Machinery Co., Grand Rapids, Mich.

Pittsburgh Machine Tool Co., Braddock, Pa.

See pages 219, 292

Pratt & Whitney Co., Hartford, Conn.

Rahn-Larmon Co., 2941 Spring Grove Ave., Cincinnati, O.

San Francisco Engineering Co., 322 & 324 6th St., San Francisco, Cal.

Sebastian Lathe Co., Box 729, Cincinnati, O.

South Bend Lathe Works, South Bend, Ind.

Wicks Bros., 512 Water St., Saginaw, Mich.

Willard Machine & Tool Co., Cincinnati, O.

Foot Power

Reed-Prentice Co., Worcester, Mass. *See page 224*

Gap

Harrington, Son & Co., Inc., Edwin, 17th & Callowhill Sts., Philadelphia, Pa.

Rahn-Larmon Co., 2941 Spring Grove Ave., Cincinnati, O.

South Bend Lathe Works, South Bend, Ind.

Gun

Johnson Jr. Co., Inc., I. H., 337 N. 15th St., Philadelphia, Pa.

Heavy Duty

Houston, Stanwood & Gamble Co., Cincinnati, O. *See pages 46, 47*

International Machine Tool Co., Indianapolis, Ind.

Pittsburgh Machine Tool Co., Braddock, Pa.

See pages 219, 292

Reed-Prentice Co., Worcester, Mass. *See page 224*

Metal-Spinning

Meriden Machine Tool Co., Meriden, Conn.
Prybil Machine Co., P., 512-524 W. 41st St., New York, N. Y.

Precision

Bradford Machine Tool Co., Cincinnati, O.

Elgin Tool Works, Elgin, Ill.

Flather & Co., Inc., 29 Crown St., Nashua, N. H.

Hardinge Brothers, Inc., 1770 Breteau Ave., Chicago, Ill.

Rivett Lathe & Grinder Co., Brighton, Boston, Mass.

Sloan & Chase Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*

Projectile

Johnson Jr. Co., Inc., I. H., 337 N. 15th St., Philadelphia, Pa.

Pulley

Cincinnati Pulley Machinery Co., Cincinnati, O.

Screw-Cutting

Automatic Machine Co., Bridgeport, Conn.

Hamilton Machine Tool Co., Hamilton, O.

Savage & Love Co., Rockford, Ill.

South Bend Lathe Works, South Bend, Ind.

Shafting

Fitchburg Machine Works, Fitchburg, Mass.

Speed

Reed-Prentice Co., Worcester, Mass. *See page 224*

Turret

Bardons & Oliver, 1133 W. 9th St., Cleveland, O.

Bradford Machine Tool Co., Cincinnati, O.

Champion Tool Works, Cincinnati, O.

Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.

Dresses Machine Tool Co., 225-239 W. McKen Ave., Cincinnati, O.

Foster Machine Co., Elkhart, Ind.

Gisholt Machine Co., Madison, Wis.

Hamilton Machine Tool Co., Hamilton, O.

***Jones & Lamson Machine Co.,** Springfield, Vt. *See pages 220, 221, 222, 223*

McCabe, J. J., 149 Broadway, New York, N. Y.

Meriden Machine Tool Co., Meriden, Conn.

Monarch Machine Tool Co., Sidney, O.

Pratt & Whitney Co., Hartford, Conn.

Reed-Prentice Co., Worcester, Mass. *See page 224*

Smurr & Kamen Co., 313 N. Whepple St., Chicago, Ill.

Steinle Turret Machine Co., Madison, Wis.

***Warner & Swasey Co.,** Cleveland, O. *See page 225*

Wood Turret Machine Co., Brazil, Ind.

Turret (Vertical)

Bullard Machine Tool Co., Bridgeport, Conn.

***King Machine Tool Co.,** Cincinnati, O.

Wheel

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Wood Turning

Badger Gas & Gasoline Engine Co., Kansas City, Kans.

LATHING (Expanded Metal)

Scammell Co., Chas. H., Metropolitan Tower, New York, N. Y.

LEACHING BATTERIES

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

LEAD

Calking

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Lea

LEAD (continued)**Pig**

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Shut

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

LEAD PIPE MACHINERY

Robertson & Co., John, 133 Water St., Brooklyn, N. Y.

LEAD PRODUCTS

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

LEATHER BELTING, PACKING, ETC.

(*See Belting, Packing, etc., Leather*)

LEATHER GOODS, MECHANICAL

Central Belting Co., 151 Lafayette St., New York, N. Y.

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.

Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.

Laurence Belting Co., 111 Chambers St., New York, N. Y.

LEATHER MACHINERY

Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

Slocumb & Co., Inc., F. F., Wilmington, Del.

LEATHER SKIVING AND SPLITTING MACHINES

Fortuna Machine Co., 127 Duane St., New York, N. Y.

LEATHERS**Friction**

Bickford & Francis Belting Co., Buffalo, N. Y.

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

*Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*

Hydraulic

Bonner & Barnwell, Inc., 30 Church St., New York, N. Y.

Consolidated Belting Co., 2 Jeffrey St., Chester, Pa.

Cook Belting Co., H. N., San Francisco, Cal. *See page 163*

Eagle Counter & Leather Co., 414-416 E. Eighth St., Cincinnati, O.

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

Provost Engineering Corp'n, Eagle & Provost Sts., Brooklyn, N. Y.

Shultz Belting Co., St. Louis, Mo. *See page 171*

Polishing

Coe & Brown, New Haven, Conn.

Pump

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

Norwich Belting Co., Norwich, Conn.

*Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*

Williams & Sons, I. B., Dover, N. H.

Textile

Himmelein & Bailey, 248 Chestnut St., Philadelphia, Pa.

LIGHTING PLANTS, ELECTRIC

American Blower Co., Detroit, Mich. *See pages 280, 281*

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Regal Gasoline Engine Co., Coldwater, Mich.

United Engine Co., Lansing, Mich.

Railroad Car

U. S. Light & Heat Corp'n, Niagara Falls, N. Y.

LIGHTING-ARRESTERS

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

LIME PLANTS

Steady-Schmidt Mfg. Co., York, Pa.

LININGS**Brake**

Carey Co., Philip, Cincinnati, O. *See page 121*

Cork Insert Co., 164 Federal St., Boston, Mass.

Federal Asbestos Co., Paterson, N. J.

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Thermoid Rubber Co., Trenton, N. J.

United States Asbestos Co., Fehl Bldg., Lancaster, Pa.

Cement Kiln

Ashland Fire Brick Co., Ashland, Ky.

Cinder Pot

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Furnace

*Best, Inc., W. N., 11 Broadway, New York, N. Y. *See page 265*

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

McLeod & Henry Co., Troy, N. Y.

Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Stack

Acme Asbestos Covering & Supply Co., 401 N. Ada St., Chicago, Ill.

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

National Air Cell Covering Co., 210-220 Van Brunt St., Brooklyn, N. Y.

LINKS, REPAIR

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

LINOLEUM MACHINERY

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

LIQUID FUEL EQUIPMENT

Anthony Co., 138 West Ave., Long Island City, N. Y. *See page 264*

*Best, Inc., W. N., 11 Broadway, New York, N. Y. *See page 265*

LOADERS**End**

Holmes & Bros., Rob't, Danville, Ill.

Log

American Hoist & Derrick Co., St. Paul, Minn.

Portable

Brown Portable Elevator Co., Chicago, Ill. *See page 179*

Wagon

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*

Haiss Mfg. Co., Geo., 141st St. & Rider Ave., New York, N. Y.

*Link-Belt Co., Chicago, Ill. *See page 178*

LOCKERS (Metal)

Darby & Sons Co., Inc., Edward, 233-235 Arch St., Philadelphia, Pa.

Durand Steel Locker Co., 76 W. Monroe St., Chicago, Ill.

Edwards Mfg. Co., 306-336 Eggleston Ave., Cincinnati, O. *See page 269*

Lyon Metallic Mfg. Co., Aurora, Ill.

*Manufacturing Equipment & Engrg. Co., Framingham, Mass.

Narragansett Machine Co., Providence, R. I.

Terrell's Equipment Co., Grand Rapids, Mich.

LOCOMOBILES

Buckeye Engine Co., Salem, O.

Lea

LOCOMOTIVES

Compressed Air

- *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
Porter Co., H. K., 1208 Union Bank Bldg., Pittsburgh, Pa.

Electric

- Atlas Car & Mfg. Co., Cleveland, O.
*General Electric Co., Schenectady, N. Y. *See pages 30, 31*
Morgan-Gardner Electric Co., Chicago, Ill.
Simplex Surface Contact Co., Williamsport, Pa.
*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Electric (Storage Battery)

- Elwell-Parker Electric Co., Cleveland, O.
*General Electric Co., Schenectady, N. Y. *See pages 30, 31*
Goodman Mfg. Co., Halstead St. & 48th Place, Chicago, Ill.
*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
*Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.
Whitcomb Co., Geo. D., Rochelle, Ill.

Fireless

- Porter Co., H. K., 1208 Union Bank Bldg., Pittsburgh, Pa.

Gasoline

- Baldwin Locomotive Works, Philadelphia, Pa.
Fate Co., J. D., Plymouth, O.
Hall-Scott Motor Car Co., Inc., Crocker Bldg., San Francisco, Cal.
McKeen Motor Car Co., Omaha, Nebr.
Whitcomb Co., Geo. D., Rochelle, Ill.

Geared

- Climax Mfg. Co., Corry, Pa.
Davenport Locomotive Works, Davenport, Ia.
Heisler Locomotive Works, 16th & Hickory Sts., Erie, Pa.
Lima Locomotive Corp'n, Lima, O.

Logging

- Heisler Locomotive Works, 16th & Hickory Sts., Erie, Pa.

Pulverized Fuel

- *Locomotive Pulverized Fuel Co., 30 Church St., New York, N. Y.

Steam

- American Locomotive Co., 30 Church St., New York, N. Y.
Baldwin Locomotive Works, Philadelphia, Pa.
Davenport Locomotive Works, Davenport, Ia.
Lima Locomotive Corp'n, Lima, O.
Palmer & Co., N., Bridgeport, Conn.
Porter Co., H. K., 1208 Union Bank Bldg., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOGGING MACHINERY

- *Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
Garland Co., M., Bay City, Mich.
*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
Marion Steam Shovel Co., Station D, Marion, O.

LOOMS, CIRCULAR

- Royle & Sons, John, Paterson, N. J.

LUBRICANTS

- Acheson Graphite Co., Niagara Falls, N. Y.
Albany Lubricating Co., 708-710 Washington St., New York, N. Y. *See page 123*
Borne, Scrymser Co., 80 South St., New York, N. Y.
Harris Oil Co., A. W., 326 South Water St., Providence, R. I.
Kellogg & Co., E. H., 243 & 244 South St., New York, N. Y.

- Lumen Bearing Co., Buffalo, N. Y. *See page 201*

- New York & New Jersey Lubricant Co., 165 Broadway, New York, N. Y.
Philadelphia Grease Mfg. Co., 848-50 S. Swanson St., Philadelphia, Pa.
Robinson & Son Co., Wm. C., 32 South St., Baltimore, Md.

- *Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*

- Stuart & Co., Inc., D. A., 29 S. La Salle St., Chicago, Ill.

- *Texas Co., 17 Battery Pl., New York, N. Y. *See page 124*

- Watt's Sons, John M., 54 N. 2nd St., Philadelphia, Pa.

- White & Bagley Co., Worcester, Mass.

- White Star Refining Co., 614-48 Avery Ave., Detroit, Mich.

Graphite

- Dixon Crucible Co., Joseph, Jersey City, N. J.
Kelly Graphite Mills, 534 W. 22nd St., New York, N. Y.
Randall Graphite Sheet Lubricator Co., 816-818 W. Lake St., Chicago, Ill.

LUBRICATORS

- Albany Lubricating Co., 708-710 Washington St., New York, N. Y. *See page 123*

- American Injector Co., Detroit, Mich. *See page 116*

- American Lubricator Co., Detroit, Mich.

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

- *Crescent Mfg. Co., Scottdale, Pa.

- Flower Co., W. L., 310 South 8th St., St. Louis, Mo.

- *Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*

- Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*

- *Lunkenheimer Co., Cincinnati, O.

- McCullough Mfg. Co., 2632-2634 Central Ave., Minneapolis, Minn.

- Ohio Injector Co., S. Main St., Wadsworth, O.

- Osgood Lubricator Co., J. L., 45 Pearl St., Buffalo, N. Y.

- Schenck Mfg. & Supply Co., Parkers Landing, Pa.

- Williams Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.

Driving Box (Locomotive)

- Franklin Railway Supply Co., 30 Church St., New York, N. Y.

Elevator

- Garland Co., M., Bay City, Mich.

Force-Feed

- Detroit Lubricator Co., Detroit, Mich. *See page 125*

- *Greene Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*

- Hills-McCanna Co., 153 W. Kinzie St., Chicago, Ill.

- Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

- Inter-State Machine Products Co., 56 Allen St., Rochester, N. Y.

- McCord Mfg. Co., Detroit, Mich. *See page 127*

- Madison-Kipp Lubricator Co., Madison, Wis. *See page 128*

- Manzel Brothers Co., 315 Babcock St., Buffalo, N. Y.

- *Pickering Governor Co., Portland, Conn. *See page 131*

- *Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*

- Sherwood Mfg. Co., Buffalo, N. Y.

Graphite

- American Graphite Feeding Device Co., Manville, R. I.

See Catalogue Section for data of firms listed in bold face type

LUBRICATORS (continued)**Hydrostatic**

- *Crescent Mfg. Co., Scottsdale, Pa.
 Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass. *See page 324*
 Detroit Lubricator Co., Detroit, Mich. *See page 125*
 Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*
 Michigan Lubricator Co., 661-701 Beaubien St., Detroit, Mich.
 Penberthy Injector Co., Detroit, Mich. *See page 117*

M**MACHINE HANDLES, SCREWS, ETC.**
(See Handles, Screws, etc., Machine)**MACHINE TOOLS**

- Acme Machine Tool Co., Cincinnati, O. *See page 218*
 Beaman & Smith Co., Providence, R. I.
 Boeger-Meyer Machine & Tool Co., 59-65 McWhorter St., Newark, N. J.
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Chicago Machine Tool Co., 127 No. Canal St., Chicago, Ill.
 Cincinnati Lathe & Tool Co., 3207 North St., Oakley, Cincinnati, O.
 Cincinnati Planer Co., Oakley, Cincinnati, O. *See page 228*
 Dill Machine Co., Inc., T. C., Philadelphia, Pa. *See page 229*
 *Fellows Gear Shop Co., Springfield, Vt. *See page 230*
 Foster Machine Co., Elkhart, Ind.
 Gooley & Edlund, Inc., Cortland, N. Y. *See page 231*
 Gray Co., G. A., Gest & Depot Sts., Cincinnati, O.
 *Jones & Lamson Machine Co., Springfield, Vt. *See pages 220, 221, 222, 223*
 Kearney & Trecker Co., Milwaukee, Wis. *See page 232*
 Kempsmith Mfg. Co., Station A., Milwaukee, Wis.
 McCabe, J. J., 149 Broadway, New York, N. Y.
 Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York, N. Y.
 Phoenix Mfg. Co., Eau Claire, Wis.
 Pittsburgh Machine Tool Co., Braddock, Pa. *See pages 219, 292*
 Rahn-Larmon Co., 2941 Spring Grove Ave., Cincinnati, O.
 Reed-Prentice Co., Worcester, Mass. *See page 224*
 Ryerson & Son, Joseph T., Chicago, Ill.
 Sebastian Lathe Co., Box 729, Cincinnati, O.
 Sellers & Co., Inc., Wm., Philadelphia, Pa.
 Shepherd Engineering Co., Williamsport, Pa.
 Smith & Mills Co., Cincinnati, O.
 Somers, Fittler & Todd Co., 327 Water St., Pittsburgh, Pa.
 Steptoe Co., John, Cincinnati, O.
 *Warner & Swasey Co., Cleveland, O. *See page 225*
 Western Machine Tool Works, Holland, Mich.
- MACHINE WORK**
 American Engine & Electric Co., Bound Brook, N. J. *See page 10*
 Automatic Machine Co., Bridgeport, Conn.
 Blair Mfg. Co., 209 S. 2nd St., Camden, N. J.
 Blount Engineering Co., 100 High St., Boston, Mass.
 Braddock Machine & Mfg. Co., Braddock, Pa.
 *Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*

- *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 *Crowley Machine Works, C. H., Fitchburg, Mass. *See page 236*
 Eastwood Wire Mfg. Co., Belleville, N. J.
 Gillespie Mfg. Corp'n, 12th & Monmouth Sts., Jersey City, N. J.
 Harris & Co., Arthur, 212 Curtis St., Chicago, Ill.
 Havana Mfg. Co., Havana, Ill.
 Hefner & Maysiles, Crafton, W. Va.
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Katzenstein & Co., L., 358 West St., New York, N. Y.
 Keller Mechanical Engraving Co., 70 Washington St., Brooklyn, N. Y.
 Klotz Machine Co., 318 W. Water St., Sandusky, O.
 *Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill. *See page 293*
 McCall Machine Works, Rochester, N. Y.
 Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
 Mehl Machine, Tool & Die Co., Roselle, N. J. *See pages 239, 239*
 Nelsonville Foundry & Machine Co., Nelsonville, O.
 Nestor Mfg. Co., 40 W. 13th St., New York, N. Y.
 Oswego Machine Works, Oswego, N. Y.
 Parker White Metal & Machine Co., 23rd & R. R. Sts., Erie, Pa.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Pusey & Jones Co., Wilmington, Del.
 Riverside Machine Co., Front & Penn Sts., Chester, Pa.
 Sackett, A. J., Baltimore, Md.
 Standard Engineering Co., Ellwood City, Pa.
 Sullivan, John N., Hickory & Mattes Sts., Scranton, Pa.
 Torrington Mfg. Co., Torrington, Conn. *See page 240*
 Townsend Furnace & Machine Shop Co., Albany, N. Y.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*
 Youngstown Engineering Co., Youngstown, O.

MACHINERY

Is classified under the headings descriptive of character thereof.

MACHINISTS' SUPPLIES

Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

MAGNESIA PRODUCTS

Ehret Magnesia Mfg. Co., Valley Forge, Pa. *See page 121*

MAGNETOS, IGNITION

Accurate Engineering Co., Chicago, Ill.
 Witherbee Igniter Co., Springfield, Mass.

MAGNETS, LIFTING

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
 Electric Controller & Mfg. Co., Cleveland, O.
 Industrial Works, Bay City, Mich. *See page 189*

MALTING MACHINERY

Dornfeld Iron Works, Watertown, Wis.

MANDRELS**Blacksmiths'**

Noyes & Co., B. B., Greenfield, Mass.

Expanding

McCrosky Reamer Co., Meadville, Pa. *See pages 246, 247*
 Western Tool & Mfg. Co., Springfield, O.

MANHOLE FITTINGS

Glasgow Iron Co., Pottstown, Pa. *See page 60*
 Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*

Lub

MANIFOLDS

American Tube Bending Co., New Haven, Conn.

MANOMETERS

American Blower Co., Detroit, Mich. *See pages 280, 281*

MARKING DEVICES

Noble & Westbrook Mfg. Co., Hartford, Conn. *See page 241*

MARKING MACHINES

Noble & Westbrook Mfg. Co., Hartford, Conn. *See page 241*

MATTING, RUBBER

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

*Goodrich Co., B. F., Akron, O. *See pages 133, 165*

Mechanical Rubber Co., Cleveland, O. *See page 169*

*Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.

MEASURING MACHINES (For Wire)

McDonnell Odometer Co., 35th St. & Kedzie Ave., Chicago, Ill.

New England Butt Co., Providence, R. I. *See page 304*

Textile Machine Works, Reading, Pa. *See page 305*

MEASURING AND MIXING MACHINES

Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*

MECHANICAL DRAFT APPARATUS

American Blower Co., Detroit, Mich. *See pages 280, 281*

Green Fuel Economizer Co., 90 West St., New York, N. Y. *See page 58*

Improved Combustion Co., Peoples Gas Bldg., Chicago, Ill.

Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Wing Mfg. Co., L. J., 352 W. 13th St., New York, N. Y.

MECHANICAL STOKERS

(*See Stokers*)

MERCHANT CASING

Monongahela Tube Co., Pittsburgh, Pa. *See page 59*

METAL BEARINGS, HOSE, PACKING, ETC.

(*See Bearings, Hose, Packing, etc., Metal*)

METAL DUST SPRAYING

Metals Coating Co. of America, 122 S. Michigan Ave., Chicago, Ill.

METAL MINING MACHINERY

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

METAL SPINNING

Consolidated Mfg. Co., Rear 28 N. Canal St., Dayton, O.

METAL TREATING

American Metal Treatment Co., Elizabeth, N. J.

METALLOGRAPHIC APPARATUS

Bausch & Lomb Optical Co., Rochester, N. Y.
Thomas Co., Arthur H., W. Washington Sq., Philadelphia, Pa.

METALLURGICAL EQUIPMENT

Dorr Co., 1009 17th St., Denver, Colo.

METALS**Acid Resistant**

Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Anti-Friction

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

American Bronze Co., Berwyn, Pa. *See pages 198, 199*

Frictionless Metal Co., Chattanooga, Tenn.

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Magnolia Metal Co., 113-115 Bank St., New York, N. Y.

Martell Packings Co., Elyria, O.

Riverside Metal Refining Co., Connellsville, Pa.

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Bearing

Ajax Metal Co., Philadelphia, Pa., and Birmingham, Ala.

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

American Brass Co., Waterbury, Conn. *See page 204*

American Bronze Co., Berwyn, Pa. *See pages 198, 199*

Bunting Brass & Bronze Co., 729 Spencer St., Toledo, O. *See page 161*

Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

Fahrig Metal Co., 34 Commerce St., New York, N. Y.

Frictionless Metal Co., Chattanooga, Tenn.

Lubricating Metal Co., 2 Rector St., New York, N. Y.

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

McNab Co., Bridgeport, Conn.

Magnolia Metal Co., 113-115 Bank St., New York, N. Y.

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Extruded

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

American Brass Co., Waterbury, Conn. *See page 204*

Gear

Lumen Bearing Co., Buffalo, N. Y. *See page 201*

Malleable Iron Fittings Co., Branford, Conn. *See page 106*

Perforated

Clinton Wire Cloth Co., Clinton, Mass.

Cross Engineering Co., Carbondale, Pa.

Harrington & King Perforating Co., 610 Union Ave., Chicago, Ill.

Manhattan Perforated Metal Co., 237 Centre St., New York, N. Y.

Mundt & Sons, Charles, 53-69 Fairmount Ave., Jersey City, N. J.

White

American Brass Co., Waterbury, Conn. *See page 204*

Empire Metal Co., Syracuse, N. Y.

Leddell Metals Co., 285 Border Ave., Long Island City, N. Y.

Murphy Metals Co., 1248 Webster Bldg., Chicago, Ill.

Parker White Metal & Machine Co., 23rd & R. R. Sts., Erie, Pa.

METER PROTECTIVE DEVICES (Electrical)

Johns-Pratt Co., 555 Capitol Ave., Hartford, Conn.

METERS**Air and Gas**

American District Steam Co., North Tonawanda, N. Y. *See page 118*

*Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.

*Bailey Meter Co., 141 Milk St., Boston, Mass. *See page 318*

*Builders Iron Foundry, Providence, R. I.

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Meriam Co., 1514 Prospect Ave., S. E., Cleveland, O.

New Jersey Meter Co., Plainfield, N. J.

Republic Flow Meters Co., 565 Washington Blvd., Chicago, Ill.

Met

See Catalogue Section for data of firms listed in bold face type

METERS (continued)**Coal (Underfeed Stoker)**

C. J. Mfg. Co., 3421 N. 5th St., Philadelphia, Pa.

Compressed Air

Kreutzberg Meter Co., 9 S. Clinton St., Chicago, Ill.

New Jersey Meter Co., Plainfield, N. J.

Condensation

Central Station Steam Co., 710 East Woodbridge St., Detroit, Mich.

Electric

(See Ammeters, Voltmeters, Wattmeters)

Feed Water

*Builders Iron Foundry, Providence, R. I.
Central Station Steam Co., 710 East Woodbridge St., Detroit, Mich.

Cookson Steam Specialty Co., 60-62 Central Ave., Cincinnati, O.

Republic Flow Meters Co., 565 Washington Blvd., Chicago, Ill.

Feed Water (Weir Type)

*Bailey Meter Co., 141 Milk St., Boston, Mass.
See page 318

Booth Co., L. M., 62 Hudson St., Jersey City, N. J.

Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. *See pages 76, 77*

Hoppes Mfg. Co., Springfield, O.

*Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Gas (Test, Wet)

Sargent Steam Meter Co., 1902 N. California Ave., Chicago, Ill.

Gasoline

Neptune Meter Co., 90 West St., New York, N. Y.

Oil

Bowser & Co., Inc., S. F., Ft. Wayne, Ind.
Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.

Kreutzberg Meter Co., 9 S. Clinton St., Chicago, Ill.

National Meter Co., 84-86 Chambers St., New York, N. Y. *See pages 28, 316*

Neptune Meter Co., 90 West St., New York, N. Y.

Worthington Pump & Mch. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Pitot Tube

*Bacharach Industrial Instrument Co., 14 Wood St., Pittsburgh, Pa.

Lockett & Co., Ltd., A. M., New Orleans, La.
Sargent Steam Meter Co., 1902 N. California Ave., Chicago, Ill.

Steam

American District Steam Co., North Tonawanda, N. Y. *See page 118*

*Bailey Meter Co., 141 Milk St., Boston, Mass.
See page 318

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*

*Builders Iron Foundry, Providence, R. I.
*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

New Jersey Meter Co., Plainfield, N. J.
Republic Flow Meters Co., 565 Washington Blvd., Chicago, Ill.

Venturi

*Builders Iron Foundry, Providence, R. I.
National Meter Co., 84-86 Chambers St., New York, N. Y. *See pages 28, 316*

Simplex Valve & Meter Co., 112 N. Broad St., Philadelphia, Pa.

Water

Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.

Gamon Meter Co., 282-296 South St., Newark, N. J.

Hersey Mfg. Co., South Boston, Mass.

National Meter Co., 84-86 Chambers St., New York, N. Y. *See pages 28, 316*

Neptune Meter Co., 90 West St., New York, N. Y.

Union Water Meter Co., 41 Harmon St., Worcester, Mass.

Worthington Pump & Mch. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Watt-Hour

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Roller-Smith Co., 233 Broadway, New York, N. Y.

MICROMETERS

Almond Mfg. Co., T. R., Ashburnham, Mass.
Davis Mfg. Co., 57th Ave. & Mitchell St., Milwaukee, Wis.

Syracuse Twist Drill Co., Syracuse, N. Y.

MICROSCOPES

Bausch & Lomb Optical Co., Rochester, N. Y.
Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

MILK BOTTLERS' MACHINERY

Rice & Adams Corp'n, Buffalo, N. Y.

MILK CAN WASHING MACHINES

Hershey Machine & Foundry Co., Manheim, Pa.

MILL SUPPLIES

Chesterton Co., A. W., 64 India St., Boston, Mass.

Somers, Fittler & Todd Co., 327 Water St., Pittsburgh, Pa.

MILLING ATTACHMENTS

Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

MILLING MACHINES**Automatic**

Cincinnati Milling Machine Co., Cincinnati, O.
Pratt & Whitney Co., Hartford, Conn.

Bench

Burke Machine Tool Co., Conneaut, O.
Carter & Hakes Machine Co., Winsted, Conn.

Sloan & Chace Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*

Wisconsin Miller Mfg. Co., Station A, Milwaukee, Wis.

Hand

Adams Co., Dubuque, Iowa.

Carter & Hakes Machine Co., Winsted, Conn.
Garrigus Machine Co., C. G., Bristol, Conn.

Morris Machine Tool Co., Court & Harriet Sts., Cincinnati, O.

Wisconsin Miller Mfg. Co., Station A, Milwaukee, Wis.

Whitney Mfg. Co., Hartford, Conn.

Heavy Duty

Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

Keyscat

Mitts & Merrill, 816 S. Franklin St., Saginaw, Mich.

Manufacturing

Cincinnati Milling Machine Co., Cincinnati, O.
Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

Oil Groove

National Machine Tool Co., 2272 Spring Grove Ave., Cincinnati, O.

Plain

Beaman & Smith Co., Providence, R. I.
Becker Milling Machine Co., Hyde Park, Boston, Mass.

Met

Chicago Machine Tool Co., 127 No. Canal St., Chicago, Ill.

Cincinnati Milling Machine Co., Cincinnati, O.

Cook Co., Asa S., Hartford, Conn.

Fosdick Machine Tool Co., Blue Rock & Apple St., Cincinnati, O.

Garvin Machine Co., Spring & Varick Sts., New York, N. Y.

Gooley & Edlund, Inc., Cortland, N. Y. *See page 231*

Gorton Machine Co., Geo., Racine, Wis.

Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

Kemp Smith Mfg. Co., Station A, Milwaukee, Wis.

Newton Machine Tool Works, Inc., 23rd & Vine Sts., Philadelphia, Pa.

Oesterlein Machine Co., Cincinnati, O.

Stephoe Co., John, Cincinnati, O.

Universal Boring Machine Co., 30 Tower St., Hudson, Mass.

Van Norman Machine Tool Co., Springfield, Mass.

*Warner & Swasey Co., Cleveland, O. *See page 225*

Planer Type

Ingersoll Milling Machine Co., Rockford, Ill.

Thread

Lees-Bradner Co., 6210 Carnegie Ave., Cleveland, O.

Waltham Machine Works, 296 Newton St., Waltham, Mass.

Universal

Cincinnati Milling Machine Co., Cincinnati, O.

Garvin Machine Co., Spring & Varick Sts., New York, N. Y.

Hendey Machine Co., Torrington, Conn.

Ingersoll Milling Machine Co., Rockford, Ill.

Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

*Le Blond Machine Tool Co., R. K., Cincinnati, O.

Valley City Machine Works, 12-16 Campau Ave., Grand Rapids, Mich.

Vertical

Cincinnati Milling Machine Co., Cincinnati, O.

Kearney & Trecker Co., Milwaukee, Wis. *See page 232*

MILLING AND DRILLING MACHINES (Combined)

Knight Machinery Co., W. B., 2019 Lucas Ave., St. Louis, Mo.

MILLS

Attrition

Bauer Bros. Co., Springfield, O.

Ball

Hardinge Conical Mill Co., 120 Broadway, New York, N. Y.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 69*

Graphite

Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

Pebble

Abbé Engineering Co., 220 Broadway, New York, N. Y.

Hardinge Conical Mill Co., 120 Broadway, New York, N. Y.

Roller

Acton, John, 118 John St., Brooklyn, N. Y.

Sand (Steel Foundry)

Frost Mfg. Co., Galesburg, Ill.

Saw (Portable)

Lyon Iron Works, Greene, N. Y.

Shingle

Novelty Iron Works Co., Dyersville, Ia.

Tube

Hardinge Conical Mill Co., 120 Broadway, New York, N. Y.

MILLS AND CRUSHERS (Sugar Cane)

Blymver Iron Works Co., Cincinnati, O.

Cook Cane Mill & Evaporator Co., 320 N. 2nd St., St. Louis, Mo.

Fulton Iron Works, St. Louis, Mo. *See page 21*

MINERAL WOOL

Acme Asbestos Covering & Supply Co., 401 N. Ada St., Chicago, Ill.

MINING MACHINERY

Blakeslee Mfg. Co., Du Quoin, Ill.

Bretting Mfg. Co., C. G., Ashland, Wis.

Chalmers & Williams, Inc., Chicago Heights, Ill.

Goodman Mfg. Co., Halstead St. & 48th Place, Chicago, Ill.

Hefner & Maysilles, Grafton, W. Va.

Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

Nelsonville Foundry & Machine Co., Nelsonville, O.

Price Pump & Engine Co., G. W., 33 Stevenson St., San Francisco, Cal.

Savage Co., W. J., Knoxville, Tenn.

Standard Diamond Drill Co., First Natl. Bank Bldg., Chicago, Ill.

Union Iron Works Co., 214 Spear St., San Francisco, Cal.

United Iron Works, Oakland, Cal.

United Iron Works Co., Springfield, Mo.

MINING AND CONCENTRATING MACHINERY

United Iron Works Co., Springfield, Mo.

MIXERS

Clay, Fertilizer, Etc.

Poole Engineering & Machine Co., Baltimore, Md.

Ransome Concrete Machinery Co., Dunellen, N. J.

Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

Concrete

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*

Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*

Knickerbocker Co., Jackson, Mich.

Ransome Concrete Machinery Co., Dunellen, N. J.

Standard Scale & Supply Co., Pittsburgh, Pa.

Steam Jacketed

Sowers Mfg. Co., 1298-1310 Niagara St., Buffalo, N. Y.

MIXING MACHINERY

Day Co., J. H., Cincinnati, O.

Holmes & Blanchard Co., 31 State St., Boston, Mass.

Foundry Sand

Standard Sand & Machine Co., Cleveland, O.

MODELS

Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn. *See page 237*

Sloan & Chace Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*

MOISTURE TESTER (Coal Samples)

Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*

MOLDING MACHINES

Arcade Mfg. Co., Freeport, Ill.

Snead & Co. Iron Works, Foot of Pine St., Jersey City, N. J.

MOLDS

Ingot

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

See Catalogue Section for data of firms listed in bold face type

MOLDS (continued)**Insulating Material**

Burroughs Co., Charles, 141-149 Commerce St., Newark, N. J.

MONEL METAL

Bayonne Casting Co., Bayonne, N. J.

MONO-RAIL SYSTEMS

(See Tramrail Systems, Overhead)

MOTION RECORDERS

*Bristol Co., Waterbury, Conn. *See page 327*

MOTOR GENERATORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

*Crocker-Wheeler Co., Ampere, N. J. *See page 32*

Eck Dynamo Motor Co., Belleville, N. J.

*General Electric Co., Schenectady, N. Y.

See pages 30, 31

Ridgway Dynamo & Engine Co., Ridgway, Pa.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTOR TRUCKS

General Vehicle Co., Inc., Long Island City, N. Y.

Pierce Arrow Motor Car Co., Buffalo, N. Y.

Emergency Repair

Pierce Arrow Motor Car Co., Buffalo, N. Y.

Special Purpose

Pierce Arrow Motor Car Co., Buffalo, N. Y.

MOTORS**Aeronautical**

Aeromotor Co., Thomas, Ithaca, N. Y.

Hall-Scott Motor Car Co., Inc., Crocker Bldg., San Francisco, Cal.

Herschell Spillman Co., North Tonawanda, N. Y.

Roberts Motor Mfg. Co., Sandusky, O.

Air and Steam

Dake Engine Co., Grand Haven, Mich.

Automobile

Hercules Motor Mfg. Co., Canton, O.

Herschell Spillman Co., North Tonawanda, N. Y.

Lamb Engine Co., Clinton, Ia.

Lycoming Foundry & Machine Co., Williamsport, Pa.

Teetor-Hartley Motor Co., Hagerstown, Md.

Compressed Air

Detroit Hoist & Machine Co., Detroit, Mich.

Draper Mfg. Co., Port Huron, Mich.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

C. & C. Electric & Mfg. Co., Garwood, N. J.

Clark, Jr., Electric Co., Jas., Louisville, Ky.

*Crocker-Wheeler Co., Ampere, N. J. *See page 32*

Diehl Mfg. Co., Elizabethport, N. J.

Dienelt & Eisenhardt Co., Inc., 1304 N. Howard St., Philadelphia, Pa.

Eck Dynamo & Motor Co., Belleville, N. J.

Electric Blower Co., 352 Atlantic Ave., Boston, Mass.

Electric Machinery Co., Minneapolis, Minn.

*Electro Dynamic Co., Bayonne, N. J.

Emerson Electric Mfg. Co., 2032-42 Washington Ave., St. Louis, Mo.

Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

Fidelity Electric Co., Lancaster, Pa.

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Kester Electric Co., 1000-1020 S. 14th St., Terre Haute, Ind.

Mechanical Appliance Co., Milwaukee, Wis.

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Phoenix Electric Co., Mansfield, O.

Reliance Electric & Engineering Co., 1054 Ivanhoe Rd., Cleveland, O.

Robbins & Myers Co., Springfield, O.

Sheffield Car Co., Three Rivers, Mich.

*Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. *See page 192*

*Sprague Electric Works, 527 W. 34th St., New York, N. Y.

Stow Mfg. Co., 443 State St., Binghamton, N. Y.

Triumph Electric & Ice Machine Co., Cincinnati, O.

Wagner Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.

Western Electric Co., Inc., 195 Broadway, New York, N. Y.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Electric (Slow & Variable Speed)

Jantz & Leist Electric Co., Cincinnati, O.

Water

Backus Water Motor Co., Newark, N. J.

Indiana Fan Co., 40 E. South St., Indianapolis, Ind.

Organ Power Co., Hartford, Conn.

MOULDED COMPOSITION

General Bakelite Co., 100 William St., New York, N. Y.

MUFFLERS

Pullman Ventilator Corp'n, York, Pa.

MULTIPLE EFFECTS

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

Zaremba Co., 707 D. S. Morgan Bldg., Buffalo, N. Y.

MUNITIONS

Bartlett Hayward Co., Baltimore, Md.

Poole Engineering & Machine Co., Baltimore, Md.

N**NICKEL**

Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*

NICKEL ANODES

Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*

NIPPLE THREADING MACHINES

Landis Machine Co., Waynesboro, Pa.

Merrell Mfg. Co., 845 Curtis St., Toledo, O.

NITROGEN GAS

Air Reduction Co., Inc., Germantown & Sedgley Aves., Philadelphia, Pa.

NITROGLYCERIN MACHINERY

Luther Mfg. Co., Olean, N. Y.

NOTCHING MACHINES**Angle**

Kidder Mfg. Co., J. F., Burlington, Vt.

Armature Disc

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Long & Allstatter Co., Hamilton, O. *See page 213*

NOZZLES**Aerating**

*Spray Engineering Co., 93 Federal St., Boston, Mass. *See page 87*

Fire

Morse & Son, Inc., Andrew J., 221 High St., Boston, Mass.

Graphite

Seidel, Inc., R. B., 1322 Callowhill St., Philadelphia, Pa.

Sand and Air

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

Mol

Advertisements of firms marked * appear in *The Journal*, A. S. M. E.

National Brake & Electric Co., Milwaukee, Wis. See pages 278, 279

Spray

Carrier Air Conditioning Co., 490 Broadway, Buffalo, N. Y.
Cooling Tower Co., 50 Broad St., New York, N. Y.

***Spray Engineering Co., 93 Federal St., Boston, Mass.** See page 87
Star Brass Works, 319-31 N. Albany Ave., Chicago, Ill.

NUT LOCKS

Columbia Nut & Bolt Co., Bridgeport, Conn.
Hart Packing Co., 144 High St., Boston, Mass.
National Lock Washer Co., Newark, N. J.

NUTS

American Iron & Steel Mfg. Co., Lebanon, Pa.
Chicago Screw Co., 1020 S. Homan Ave., Chicago, Ill.
Garland Nut & Rivet Co., West Pittsburgh, Pa.
National Bolt & Nut Co., 62nd & A. V. R. R., Pittsburgh, Pa.
Ohio Nut & Bolt Co., Breia, O.
Rhode Island Tool Co., Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. See page 250
Western Automatic Machine Screw Co., Elyria, O.

Castellated

Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.
Milton Mfg. Co., Milton, Pa. See page 258
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. See page 259

Cold Punched

Milton Mfg. Co., Milton, Pa. See page 258
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. See page 259

Hot Pressed

Milton Mfg. Co., Milton, Pa. See page 258

Lock

Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.

Semi-Finished

Milton Mfg. Co., Milton, Pa. See page 258
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. See page 259
St. Louis Screw Co., St. Louis, Mo.

O

ODOMETERS

Veeder Mfg. Co., Hartford, Conn. See page 341

OHMMETERS

Thompson-Levering Co., 323 Arch St., Philadelphia, Pa.

OIL AND GREASE CUPS

Albany Lubricating Co., 708-710 Washington St., New York, N. Y. See page 123
American Injektor Co., Detroit, Mich. See page 116
American Lubricator Co., Detroit, Mich.
American Specialty Co., 20 East Madison St., Chicago, Ill.
Bowen Mfg. Co., Auburn, N. Y.
*Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
*Crescent Mfg. Co., Scottsdale, Pa.
Detroit Lubricator Co., Detroit, Mich. See page 125
Keystone Lubricating Co., Philadelphia, Pa.
Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325

*Lunkenheimer Co., Cincinnati, O.
Merchant & Evans Co., 2010-2035 Washington Ave., Philadelphia, Pa.
Penberthy Injector Co., Detroit, Mich. See page 117
Rich Mfg. Co., 370 Atlantic Ave., Boston, Mass.
Tucker, W. R. & C. F., Hartford, Conn.
Wahlstrom Tool Co., 346 Carroll St., Brooklyn, N. Y.

OIL BURNERS, ENGINES, FILTERS, PUMPS, ETC.

(See Burners, Engines, Filters, Pumps, etc., Oil)

OIL BURNING EQUIPMENT

Anthony Co., 138 West Ave., Long Island City, N. Y. See page 264
*Best, Inc., W. N., 11 Broadway, New York, N. Y. See page 265
*Gilbert & Barker Mfg. Co., Springfield, Mass. See page 266
Hammel Oil Burning Equipment Co., 350 Pearl St., New York, N. Y.
Johnson Co., S. T., 1337 Mission St., San Francisco, Cal.
Lockett & Co., Ltd., A. M., New Orleans, La.
Mirces Fuel Oil Equipment Co., Lancaster, Pa.
National Supply Co., 416 W. Grand Ave., Chicago, Ill.
Quigley Furnace Specialties Co., Inc., 26 Cortlandt St., New York, N. Y.

OIL CLOTH PRINTING MACHINERY

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

OIL FILTERING SYSTEMS

Bowser & Co., Inc., S. F., Ft. Wayne, Ind.
*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. See page 129

OIL MILL MACHINERY

Bauer Bros. Co., Springfield, O.
Carver Cotton Gin Co., East Bridgewater, Mass.
Platt Iron Works, Dayton, O. See page 290
Sprout Waldron & Co., Muncy, Pa.

OIL RECLAIMERS

De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. See page 25

OIL REFINERY EQUIPMENT

Petroleum Iron Works Co., Sharon, Pa.
Reeves Bro. Co., Alliance, O.
Standard Boiler & Plate Iron Co., Niles, O.

OIL SEPARATING MACHINES (Centrifugal)

D'Olier Centrifugal Pump & Machine Co., Morris Bldg., Philadelphia, Pa.
National Separator & Machine Co., 89 State St., Boston, Mass.
Oil & Waste Saving Machine Co., 1509 Real Estate Trust Bldg., Philadelphia, Pa. See page 130

OIL STORAGE OUTFITS

American Oil Pump & Tank Co., Central & Kindel Aves., Cincinnati, O.
Wayne Oil Tank & Pump Co., Fort Wayne, Ind.

OIL STORAGE SYSTEMS

*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. See page 129

OIL TESTING APPARATUS

Eimer & Amend, 205-211 Third Ave., New York, N. Y. See page 335
Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. See page 330

OIL TESTING MACHINES

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. See page 312
Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. See page 313

Oil

See Catalogue Section for data of firms listed in bold face type

OIL WELL MACHINERY

Lucy Mfg. Corp'n of Texas, 208 Texas Co. Bldg., Houston, Tex.

OIL WELL SUPPLIES

Armstrong Mfg. Co., Waterloo, Ia.
Hughes Tool Co., Houston, Texas.
McEwen Bros., Wellsville, N. Y.
Pittsburgh Valve & Fittings Co., Barberton, O.

OILING DEVICES

American Injector Co., Detroit, Mich. *See page 116*
Inter-State Machine Products Co., 56 Allen St., Rochester, N. Y.
Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*
Nugent & Co., Wm. W., 146-148 W. Superior St., Chicago, Ill.
Pittsburgh Gage & Supply Co., Pittsburgh, Pa.
*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*
Wilcox Mfg. Co., E. A., 6330 Stony Island Ave., Chicago, Ill.

OILING SYSTEMS

Famous Filter Co., 308 N. Commercial St., St. Louis, Mo.
Nugent & Co., Wm. W., 146-148 W. Superior St., Chicago, Ill.
Pittsburgh Gage & Supply Co., Pittsburgh, Pa.
Power Plant Specialties, 219 Ruffner St., Lockland, O.
*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*
Turner Oil Filter Co., Niles, Mich.

OILS

Albany Lubricating Co., 708-710 Washington St., New York, N. Y. *See page 123*
American Oil Products Co., 1428-38 Seneca St., Buffalo, N. Y.
Borne, Scrymser Co., 80 South St., New York, N. Y.
Dearborn Chemical Co., McCormick Bldg., Chicago, Ill.
Eagle Oil & Supply Co., 44-46 India St., Boston, Mass.
Gearhart Oil Burner Co., 1314 Eye St., Fresno, Cal.
Harris Oil Co., A. W., 326 South Water St., Providence, R. I.
Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.
Indian Refining Co., Inc., 44 Whitehall St., New York, N. Y.
Kellogg & Co., E. H., 243 & 244 South St., New York, N. Y.
Kramer Oil Co., W. J., Milwaukee, Wis.
Moore Oil Co., Cincinnati, O.
New York & New Jersey Lubricant Co., 165 Broadway, New York, N. Y.
Platt & Washburn Refining Co., 11 Broadway, New York, N. Y.
Robinson & Son Co., Wm. C., 32 South St., Baltimore, Md.
Standard Oil Co. of New York, 26 Broadway, New York, N. Y.
Star Oil Co., 440 N. Halstead St., Chicago, Ill.
Stuart & Co., Inc., D. A., 29 S. La Salle St., Chicago, Ill.
*Texas Co., 17 Battery Pl., New York, N. Y. *See page 124*
White & Bagley Co., Worcester, Mass.
White Star Refining Co., 614-48 Avery Ave., Detroit, Mich.
Wolverine Lubricants Co. of New York, 80 Broad St., New York, N. Y.

Fuel

Indian Refining Co., Inc., 44 Whitehall St., New York, N. Y.
Platt & Washburn Refining Co., 11 Broadway, New York, N. Y.
*Texas Co., 17 Battery Pl., New York, N. Y. *See page 124*

OPERATION RECORDERS

Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y. *See page 337*

OPTICAL PYROMETERS

(See Pyrometers, Optical)

ORE HANDLING MACHINERY

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
*Link-Belt Co., Chicago, Ill. *See page 178*
Robins Conveying Belt Co., Park Row Bldg., New York, N. Y.
Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, O.

ORE WASHING MACHINERY

Colorado Iron Works Co., Box 989, Denver, Colo.
Davis Foundry & Machine Works, Rome, Ga.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.

ORNAMENTAL WORK**Brass**

Meyers Mfg. Co., Fred J., Hamilton, O.

Iron and Bronze

Bolles Iron & Wire Works, J. E., 53 Porter St., Detroit, Mich.
Meyers Mfg. Co., Fred J., Hamilton, O.
Smith-Rhea Co., Baltimore, Md.
Wright Wire Co., Worcester, Mass.

OVENS

Koven & Brother, L. O., Jersey City, N. J. *See page 301*

By-product Coke

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

By-product Gas

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

Core

Leyshon & Lane, Inc., Trussed Concrete Bldg., Detroit, Mich.

Sectional

Oven Equipment & Mfg. Co., New Haven, Conn.

OVERHAULING MACHINES

Poole Engineering & Machine Co., Baltimore, Md.

OVERHEAD TRACK SYSTEMS

(See Tramrail Systems, Overhead)

OXY-ACETYLENE APPARATUS

Davis-Bournonville Co., Marion Station, Jersey City, N. J.
Henderson-Willis Welding & Cutting Co., 2305-7-9 N. 11th St., St. Louis, Mo.
Milburn Co., Alexander, 1420-1426 W. Baltimore St., Baltimore, Md.
Steel Products Co., Cleveland, O.
Waterhouse Welding Co., Boston, Mass.

OXY-ACETYLENE GAGES

(See Gages, Oxy-Acetylene)

OXY-ACETYLENE SUPPLIES

Waterhouse Weldong Co., Boston, Mass.

OXY-ACETYLENE WELDING

(See Welding, Oxy-Acetylene)

OXYGEN GAS

Air Reduction Co., Inc., Germantown & Sedgley Aves., Philadelphia, Pa.
Linde Air Products Co., 42nd St. Bldg., New York, N. Y.

P**PACKING****Ammonia**

American Huhn Metallic Packing Co., 141 Broadway, N. Y.
Brandt, Randolph, 70 Cortlandt St., New York, N. Y.

Buhne Metal Packing Co., 93 Nassau St., New York, N. Y.
 Carey Co., Philip, Cincinnati, O. *See page 121*
 Clark Flexible Metallic Packing Co., Portland, Me.
 Crandall Packing Co., Palmyra, N. Y.
 Paine Metallic Packing Co., Shawanese, Pa.

Asbestos

Acme Asbestos Covering & Supply Co., 401 N. Ada St., Chicago, Ill.
 Carey Co., Philip, Cincinnati, O.
 Danubil Co., 263 Broadway, New York, N. Y.
 Essex Rubber Co., Trenton, N. J.
 Franklin Mfg. Co., Franklin, Pa. *See page 121*

*Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
 New Jersey Asbestos Co., 1 Water St., New York, N. Y.

Steam Equipment Mfg. Co., 8077 Jenkins Arcade Bldg., Pittsburgh, Pa.

Vanda Co., 38 East 25th St., New York, N. Y.

Asbestos & Rubber

Danubil Co., 263 Broadway, New York, N. Y.

Fibre

Anchor Packing Co., 608 Lafayette Bldg., Philadelphia, Pa.

Fibre Finishing Co., 27 State St., Boston, Mass.

Hydraulic

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

Brandt, Randolph, 70 Cortlandt St., New York, N. Y.

Buhne Metal Packing Co., 93 Nassau St., New York, N. Y.

Carey Co., Philip, Cincinnati, O. *See page 121*

Cassco Bar-Metallic Packing Co., 8 S. Dearborn St., Chicago, Ill.

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.

Crandall Packing Co., Palmyra, N. Y.
 Detroit Leather Specialty Co., Inc., 15 Beecher St., Detroit, Mich.

"Double Service" Packing Co., 246 Chestnut St., Philadelphia, Pa.

Eagle Oil & Supply Co., 44-46 India St., Boston, Mass.

*Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*

*Goodrich Co., B. F., Akron, O. *See pages 133, 165*

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Mabbs Hydraulic Packing Co., 431 S. Dearborn St., Chicago, Ill.

Maguire Rubber Co., 30 Church St., New York, N. Y.

Martell Packings Co., Elyria, O.

Mechanical Rubber Co., Cleveland, O. *See page 169*

*Power Specialty Co., 111 Broadway, New York, N. Y.

Provost Engineering Corp'n, Eagle & Provost Sts., Brooklyn, N. Y.

*Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*

Steel Mill Packing Co., Detroit, Mich.
 United States Asbestos Co., Fehl Bldg., Lancaster, Pa.

Watt's Sons, John M., 54 N. 2nd St., Philadelphia, Pa.

Leather

Detroit Leather Specialty Co., Inc., 15 Beecher St., Detroit, Mich.

Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*

Michigan Leather Packing Co., Detroit, Mich.
 *Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*

Metallic

Allan & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

American Huhn Metallic Packing Co., 141 Broadway, New York, N. Y.

American Metallic Packing Co., Mexico Ave., N. S., Pittsburgh, Pa.

Cassco Bar-Metallic Packing Co., 8 S. Dearborn St., Chicago, Ill.

Clark Flexible Metallic Packing Co., Portland, Me.

Comee Metallic Packing Co., 409 Jefferson St., Stevens Point, Wis.

Cunningham Metallic Packing Co., Kingsbridge, New York, N. Y.

France Packing Co., 6550 State Road, Tacony, Philadelphia, Pa.

Garlock Packing Co., Palmyra, N. Y.

Gasket Supply Co., 1729 Ludlow St., Philadelphia, Pa.

Goetze Gasket & Packing Co., New Brunswick, N. J.

High-Speed Metallic Packing Co., 305 N. Michigan Ave., Chicago, Ill.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Katzenstein & Co., L., 358 West St., New York, N. Y.

Lubricating Metal Co., 2 Rector St., New York, N. Y.

Martell Packings Co., Elyria, O.

Paine Metallic Packing Co., Shawanese, Pa.

Steel Mill Packing Co., Detroit, Mich.

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

U. S. Metallic Packing Co., 429 North 13th St., Philadelphia, Pa.

Rawhide

Mabbs Hydraulic Packing Co., 431 S. Dearborn St., Chicago, Ill.

Rod (Piston and Valve)

Advance Packing & Supply Co., Chicago, Ill.

Allan & Son, A., 494 Greenwich St., New York, N. Y.

American Huhn Metallic Packing Co., 141 Broadway, New York, N. Y.

American Metallic Packing Co., Mexico Ave., N. S., Pittsburgh, Pa.

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

Brandt, Randolph, 70 Cortlandt St., New York, N. Y.

Buhne Metal Packing Co., 93 Nassau St., New York, N. Y.

Burgmann, Feodor, 26 Cortlandt St., New York, N. Y.

Cassco Bar-Metallic Packing Co., 8 S. Dearborn St., Chicago, Ill.

Chesterton Co., A. W., 64 India St., Boston, Mass.

Clark Flexible Metallic Packing Co., Portland, Me.

Comee Metallic Packing Co., 409 Jefferson St., Stevens Point, Wis.

Crandall Packing Co., Palmyra, N. Y.

Federal Asbestos Co., Paterson, N. J.

France Packing Co., 6550 State Road, Tacony, Philadelphia, Pa.

Gasket Supply Co., 1729 Ludlow St., Philadelphia, Pa.

*Goodrich Co., B. F., Akron, O. *See pages 133, 165*

*Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*

High-Speed Metallic Packing Co., 305 N. Michigan Ave., Chicago, Ill.

Holmes Metallic Packing Co., Wilkes-Barre, Pa.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

Pac

See Catalogue Section for data of firms listed in bold face type

PACKING (continued)**Rod (Piston and Valve)**

- ***Johns-Manville Co.**, H. W., 296 Madison Ave., New York, N. Y. *See page 119*
Jones & Co., Inc., B. M., 141 Milk St., Boston, Mass.
Knowlton Rubber Co., Geo. W., 60 Pearl St., Boston, Mass.
Mechanical Rubber Co., Cleveland, O. *See page 169*
New Jersey Asbestos Co., 1 Water St., New York, N. Y.
Paine Metallic Packing Co., Shawanese, Pa.
 ***Quaker City Rubber Co.**, 629 Market St., Philadelphia, Pa.
Squires & Byrne Rubber Co., 67 Steuart St., San Francisco, Cal.
Standard Mfg. & Supply Co., 30 N. 4th St., Philadelphia, Pa.
Steel Mill Packing Co., Detroit, Mich.
United Lead Co., 111 Broadway, New York, N. Y. *See page 202*
U. S. Flexible Metallic Tubing Co., 430 Boyd St., Los Angeles, Cal.
U. S. Metallic Packing Co., 429 North 13th St., Philadelphia, Pa.
Vanda Co., 38 East 25th St., New York, N. Y.
Wilcox Mfg. Co., E. A., 6330 Stony Island Ave., Chicago, Ill.

Rubber

- Belmont Packing & Rubber Co.**, 133 N. 2nd St., Philadelphia, Pa.
Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
Danubil Co., 263 Broadway, New York, N. Y.
Empire Rubber & Tire Co., Trenton, N. J.
Essex Rubber Co., Trenton, N. J.
 ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*
Goodyear Tire & Rubber Co., Akron, O.
 ***Jenkins Bros.**, 80 White St., New York, N. Y. *See pages 96, 97*
 ***Johns-Manville Co.**, H. W., 296 Madison Ave., New York, N. Y. *See page 119*
Knowlton Rubber Co., Geo. W., 60 Pearl St., Boston, Mass.
Mechanical Rubber Co., Chicago, Ill.
Mechanical Rubber Co., Cleveland, O. *See page 169*
Mercer Rubber Co., Hamilton Square, Trenton, N. J.
New Jersey Asbestos Co., 1 Water St., New York, N. Y.
New York Belting & Packing Co., 91-93 Chambers St., New York, N. Y.
New York Rubber Co., 84-86 Reade St., New York, N. Y.
Peerless Rubber Mfg. Co., 31 Warren St., New York, N. Y.
 ***Quaker City Rubber Co.**, 629 Market St., Philadelphia, Pa.
Revere Rubber Co., 59 Reade St., New York, N. Y.
Squires & Byrne Rubber Co., 67 Steuart St., San Francisco, Cal.
Thermoid Rubber Co., Trenton, N. J.
Voorhees Rubber Mfg. Co., 18-56 Bostwick Ave., Jersey City, N. J.

Sheet

- ***American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*
Anchor Packing Co., 608 Lafayette Bldg., Philadelphia, Pa.
Belmont Packing & Rubber Co., 133 N. 2nd St., Philadelphia, Pa.
Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
Burgmann, Feodor, 26 Cortlandt St., New York, N. Y.
 ***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
Danubil Co., 263 Broadway, New York, N. Y.

- Durable Mfg. Co.**, 114 Liberty St., New York, N. Y.
Endura Mfg. Co., 63rd & Eastwick Ave., Philadelphia, Pa.
Federal Asbestos Co., Paterson, N. J.
Fibre Finishing Co., 27 State St., Boston, Mass.
Garlock Packing Co., Palmyra, N. Y.
 ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*
Hart Packing Co., 144 High St., Boston, Mass.
 ***Jenkins Bros.**, 80 White St., New York, N. Y. *See pages 96, 97*
 ***Johns-Manville Co.**, H. W., 296 Madison Ave., New York, N. Y. *See page 119*
Johns-Pratt Co., 555 Capitol Ave., Hartford, Conn.
La Favorite Rubber Mfg. Co., Hawthorne, N. J.
Mechanical Rubber Co., Cleveland, O. *See page 169*
Pennsylvania Rubber Co., Jeanette, Pa.
 ***Quaker City Rubber Co.**, 629 Market St., Philadelphia, Pa.
Squires & Byrne Rubber Co., 67 Steuart St., San Francisco, Cal.
Vanda Co., 38 East 25th St., New York, N. Y.

Throttle (Locomotive)

- Union Machine Co.**, 183-5 University Ave., St. Paul, Minn.

PAINT MACHINERY

- Day Co.**, J. H., Cincinnati, O.
Holmes & Blanchard Co., 31 State St., Boston, Mass.

Belt

- Sawyer Belting Co.**, Cleveland, O.

PAINTS**Asbestos**

- Acme Asbestos Covering & Supply Co.**, 401 N. Ada St., Chicago, Ill.

PANS**Acidulating**

- Stedmans Foundry & Machine Works**, Aurora, Ind.

Assembling Work

- Honhorst Co.**, Jos., Cincinnati, O.
Katzinger Co., Edward, 120 N. Peoria St., Chicago, Ill.

Drip

- Katzinger Co.**, Edward, 120 N. Peoria St., Chicago, Ill.

Grinding

- Frost Mfg. Co.**, Galesburg, Ill.

Special Purpose (All Gauges)

- Katzinger Co.**, Edward, 120 N. Peoria St., Chicago, Ill.

Storage (For Machine Parts)

- Katzinger Co.**, Edward, 120 N. Peoria St., Chicago, Ill.

Vacuum

- Badger & Sons Co.**, E. B., 63 Pitt St., Boston, Mass.
Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
Kilby Mfg. Co., 4623 Lakeside Ave., Cleveland, O.
Manistee Iron Works Co., Manistee, Mich. *See page 287*
Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*
Zaremba Co., 707 D. S. Morgan Bldg., Buffalo, N. Y.

Vacuum (Steam Jacketed)

- Sowers Mfg. Co.**, 1298-1310 Niagara St., Buffalo, N. Y.

PAPER, ABRASIVE

- Carborundum Co.**, Niagara Falls, N. Y. *See page 248*

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

PAPER BAG MACHINERY

Dienelt & Eisenhardt, Inc., 1304 N. Howard St., Philadelphia, Pa.

PAPER FOLDING MACHINES

Chambers Bros. Co., 52nd & Media Sts., Philadelphia, Pa.
Dexter Folder Co., 200 Fifth Ave., New York, N. Y.

PAPER MILL MACHINERY

Bagley & Sewall Co., Watertown, N. Y.
Currier & Sons, Cyrus, Newark, N. J.
Dowington Mfg. Co., East Dowington, Pa.
*Holyoke Machine Co., Holyoke, Mass.
Jones & Sons Co., E. D., 25 Depot St., Pittsfield, Mass.
Knowlton Co., M. D., Rochester, N. Y.
Norwood Engineering Co., Florence, Mass.
Pusey & Jones Co., Wilmington, Del.
Sandusky Foundry & Machine Co., Sandusky, O.
Union Iron Wks., 15 Oak St., Bangor, Me.

PAPER PULP MACHINERY

Bagley & Sewall Co., Watertown, N. Y.
Dowington Mfg. Co., East Dowington, Pa.
Pusey & Jones Co., Wilmington, Del.
Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

PARAFFINE WAX PLANTS

Carbondale Machine Co., Carbondale, Pa. *See page 307*
Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

PARTITIONS**Rolling**

Edwards Mfg. Co., 306-336 Eggleston Ave., Cincinnati, O. *See page 269*
Wilson Corp'n, J. G., Norfolk, Va.

Steel

Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

PASTEURIZERS

Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*

PATTERN SHOP MACHINERY

Oliver Machinery Co., Grand Rapids, Mich.

PATTERNS (Metal and Wood)

Buffalo Gear & Pattern Works, 16-20 Elk St., Buffalo, N. Y.
Klotz Machine Co., 318 W. Water St., Sandusky, O.
Mehl Machine, Tool & Die Co., Roselle, N. J. *See pages 238, 239*
Mummert-Dixon Co., Hanover, Pa.
Townsend Furnace & Machine Shop Co., Albany, N. Y.
Walker Bros. Co., 225 Walton St., Syracuse, N. Y.
Wallace, J. D., 527-529 W. Van Buren St., Chicago, Ill.

Gear, Machine Cut (Wooden)

Buffalo Gear & Pattern Works, 16-20 Elk St., Buffalo, N. Y.

PAVING BLOCKS, ASPHALT

Hastings Pavement Co., 25 Broad St., New York, N. Y. *See page 270*

PAVING PLANTS, ASPHALT

Cummer & Son Co., F. D., 413 The Arcade, Cleveland, O.
Warren Brothers Co., 142 Berkeley St., Boston, Mass.

PEBBLE MILLS

(See Mills, Pebble)

PETROLEUM PRODUCTS

*Texas Co., 17 Battery Pl., New York, N. Y. *See page 124*

PHOTO-ENGRAVERS' MACHINERY

Royle & Sons, John, Paterson, N. J.

PIANO ACTION MACHINES

Nilson Machine Co., A. H., 1525 Railroad Ave., Bridgeport, Conn.

PILE DRIVERS

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*

Industrial Works, Bay City, Mich. *See page 189*

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*

McMyler Interstate Co., Bedford, O.
Union Iron Works, Hoboken, N. J.

Sheet

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

PILING, SHEET (Steel)

Lackawanna Steel Co., Lackawanna, N. Y.

PILING MACHINES, CASE

N. Y. Revolving Portable Elevator Co., 343-351 Garfield Ave., Jersey City, N. J. *See page 183*

PILLOW BLOCKS

Bond Foundry & Machine Co., Manheim, Lancaster Co., Pa.

Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*

*Wood's Sons Co., T. B., Chambersburg, Pa. *See pages 150, 151*

PIN MACHINES

Baird Machine Co., Bridgeport, Conn.

PINION CUTTING MACHINES (Clock and Watch)

Davenport Machine Tool Co., New Bedford, Mass.

Sloan & Chace Mfg. Co., Ltd., 6th Ave., Cor. N. 13th St., Newark, N. J. *See page 233*

PINIONS**Rawhide**

Ganschow Co., William, Chicago, Ill.
*New Process Gear Corp'n, Syracuse, N. Y.

Steel

Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*

Tool Steel Gear & Pinion Co., Cincinnati, O.
Van Dorn & Dutton Co., Cleveland, O. *See page 141*

PINS, TAPER

Belvidere Screw & Machine Co., Belvidere, Ill.

PIPE**Cast Iron (Bell & Spigot)**

*American Cast Iron Pipe Co., Birmingham, Ala.

*Central Foundry Co., 90 West St., New York, N. Y. *See page 105*

*Clow & Sons, James B., Chicago, Ill.

*Donaldson Iron Co., Emaus, Pa.

*Glamorgan Pipe & Foundry Co., Lynchburg, Va.

*Lynchburg Foundry Co., Lynchburg, Va.

*Massillon Iron & Steel Co., Massillon, O.

*Standard Cast Iron Pipe & Foundry Co., Bristol, Pa.

*U. S. Cast Iron Pipe & Foundry Co., Philadelphia, Pa.

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Cast Iron (Flanged)

*American Cast Iron Pipe Co., Birmingham, Ala.

American District Steam Co., North Tonawanda, N. Y. *See page 118*

Central Foundry Co., 90 West St., New York, N. Y. *See page 105*

*Clow & Sons, James B., Chicago, Ill.

*Donaldson Iron Co., Emaus, Pa.

*Glamorgan Pipe & Foundry Co., Lynchburg, Va.

*Lynchburg Foundry Co., Lynchburg, Va.

*Massillon Iron & Steel Co., Massillon, O.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

*Standard Cast Iron Pipe & Foundry Co., Bristol, Pa.

See Catalogue Section for data of firms listed in bold face type

PIPE (continued)

Cast Iron (Flanged)

- *U. S. Cast Iron Pipe & Foundry Co., Philadelphia, Pa.
 *Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Flexible

- Barco Brass & Joint Co., 212-222 W. Illinois St., Chicago, Ill.

Iron, Lead Lined

- United Lead Co., 111 Broadway, New York, N. Y. See page 202

Lead

- United Lead Co., 111 Broadway, New York, N. Y. See page 202

Riveted

- Abendroth & Root Mfg Co., 45 Broadway, New York, N. Y.
 American Spiral Pipe Works, Chicago, Ill.
 Baker Iron Works, 950 N. Broadway, Los Angeles, Cal.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 *Keeler Co., E., Williamsport, Pa. See page 45
 Koven & Brother, L. O., Jersey City, N. J. See page 301
 McAleenan Bros. Co., Pittsburgh, Pa.
 Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. See page 50
 Phoenix Iron Works Co., Meadville, Pa. See page 53
 Ruemmel-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.
 *Springfield Boiler & Mfg. Co., Springfield, Ill. See page 54
 Warren City Tank & Boiler Co., Warren, O.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. See pages 180, 181, 182

Sewer (Glazed)

- Evans & Howard Fire Brick Co., 920 Market St., St. Louis, Mo.

Soil

- Central Foundry Co., 90 West St., New York, N. Y. See page 105

Steel

- Byers Co., A. M., Pittsburgh, Pa.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 La Belle Iron Works, Steubenville, O.
 National Tube Co., Pittsburgh, Pa.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Youngstown Sheet & Tube Co., Youngstown, O.

Tin Lined

- United Lead Co., 111 Broadway, New York, N. Y. See page 202

Welded

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Wood

- American District Steam Co., North Tonawanda, N. Y. See page 118
 Wyckoff & Son Co., A., Elmira, N. Y. See pages 122, 291

Wrought Iron

- Byers Co., A. M., Pittsburgh, Pa.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Monongahela Tube Co., Pittsburgh, Pa. See page 59
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

PIPE CLAMPS, COILS, COVERINGS, CUTTERS, FITTINGS, JOINTS, ETC.

(See Clamps, Coils, Coverings, Cutters, Fittings, Joints, etc., Pipe)

PIPE CUTTING AND THREADING MACHINES

- Borden Co., Warren, O.
 Cox & Sons Co., Bridgeton, N. J.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Curtis & Curtis Co., Bridgeport, Conn.
 Jarecki Mfg. Co., Erie, Pa.
 Johnston Co., Wm. T., Cincinnati, O.
 Landis Machine Co., Waynesboro, Pa.
 Merrell Mfg. Co., 845 Curtis St., Toledo, O.
 Pipe Machinery Co., 4907 Mead Ave., Cleveland, O.
 Sanders Sons, Inc., D., 21 Atherton St., Yonkers, N. Y.
 San Francisco Engineering Co., 322-324 6th St., San Francisco, Cal.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Standard Engineering Co., Ellwood City, Pa.
 Treadwell Engineering Co., 140 Cedar St., New York, N. Y.
 Williams Tool Co., Erie, Pa.

PIPE BENDING MACHINES

- Pedrick Tool & Machine Co., Lawrence St. & Erie Ave., Philadelphia, Pa.
 Riverside Machine Co., Front & Penn Sts., Chester, Pa.

PIPE CUTTING-OFF MACHINES

- Merrell Mfg. Co., 845 Curtis St., Toledo, O.

PIPE EXPANDING AND FLANGING MACHINES

- Lovekin Pipe Expanding & Flanging Machine Co., 421 Chestnut St., Philadelphia, Pa.

PIPE JOINT COMPOUND

(See Cement, Pipe Joint)

PIPE MILL MACHINERY

- Standard Engineering Co., Ellwood City, Pa.

PIPE THREADING DEVICES

(See Thread Cutting Tools)

PIPING, POWER

- American District Steam Co., North Tonawanda, N. Y. See page 118
 Best Co., 3221 Spruce Way, Pittsburgh, Pa.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 General Fire Extinguisher Co., 275 West Exchange St., Providence, R. I.
 Kellogg Co., M. W., 92 West St., New York, N. Y.
 Limbert & Co., Geo. B., 570 Fulton St., Chicago, Ill.
 National Valve & Mfg. Co., Pittsburgh, Pa.
 Parks Co., G. M., Fitchburg, Mass.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Shaw-Kendall Engineering Co., Toledo, O.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Simmons Pipe Bending Works, 40 Mechanic St., Newark, N. J.
 *Walworth Mfg. Co., Boston, Mass.

PISTON PINS

- Michigan Screw Co., Lansing, Mich.

PISTON RINGS

- American Metallic Packing Co., Mexico Ave., N. S., Pittsburgh, Pa.
 Baker Valve Co., 1855 E. 28th St., Minneapolis, Minn.
 Keys Piston Ring Co., Inc., 3047-51 Olive St., St. Louis, Mo.
 Micro Piston Ring Co., 1960 Broadway, New York, N. Y.
 Nilsch-Miller Co., 1300 Hudson St., Hoboken, N. J.
 Provost Engineering Corp'n, Eatle & Provost Sts., Brooklyn, N. Y.
 Teetor-Hartley Motor Co., Hagerstown, Md.

Pip

Advertisements of firms marked * appear in The Journal, A. S. M. E.

PISTON TURNING MACHINES (Automobile)
Cleveland Automatic Machine Co., 2269 Ashland Road, Cleveland, O.**PISTONS****Aluminum**

Basle-Adams Engineering Co., 14-16 Cambria St., Boston, Mass.

Gasoline Engine

Dyer Co., G. H., Cambridge, Mass.

PITOT TUBESAmerican Blower Co., Detroit, Mich. *See pages 280, 281***PLANNER ATTACHMENTS**

Adams Co., Dubuque, Iowa.

Cincinnati Planer Co., Oakley, Cincinnati, O. *See page 228***PLANERS, METAL**

American Tool Works Co., Cincinnati, O.

Betts Machine Co., Wilmington, Del.

Bridgeport Engineering Co., Bridgeport, Conn.

Cincinnati Planer Co., Oakley, Cincinnati, O. *See page 228*

Cleveland Planer Works, 3148 Superior Ave., Cleveland, O.

Detrick & Harvey Machine Co., Baltimore, Md.

Gray Co., G. A., Gest & Depot Sts., Cincinnati, O.

Hamilton Machine Tool Co., Hamilton, O.

Hilles & Jones Co., Wilmington, Del.

Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York, N. Y.

Morton Mfg. Co., Muskegon Heights, Mich.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Powell Machine Co., 243 Stafford St., Worcester, Mass.

Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

Wilson Machine Co., W. A., 217 N. Water St., Rochester, N. Y.

Woodward & Powell Planer Co., 97 Webster St., Worcester, Mass.

Plate

Covington Machine Co., 14 Wall St., New York, N. Y.

Variable SpeedCincinnati Planer Co., Oakley, Cincinnati, O. *See page 228***PLANIMETERS**

Robertson & Sons, James L., 78-80 Murray St., New York, N. Y.

Trill Indicator Co., Corry, Pa.

PLANING MACHINES, WOOD

Wallace, J. D., 527-529 W. Van Buren St., Chicago, Ill.

PLASTER MILL MACHINERY

Ehrsam & Sons Mfg. Co., J. B., Enterprise, Kan.

PLATE METAL WORK

(See Steel Plate Construction)

PLATES**Arch (Boiler)**

Lamprey Co., 43 Broad St., Westfield, Mass.

BoilerGlasgow Iron Co., Pottstown, Pa. *See page 60*Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*

Scully Steel & Iron Co., Chicago, Ill.

Iron and Steel

Allegheny Steel Co., Pittsburgh, Pa.

Central Iron & Steel Co., Harrisburg, Pa.

Glasgow Iron Co., Pottstown, Pa. *See page 60*Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*

Midvale Steel Co., Widener Bldg., Philadelphia, Pa.

Screw

(See Screw Plates)

Tie (Rolled Iron)

Interstate Iron & Steel Co., Chicago, Ill.

UniversalGlasgow Iron Co., Pottstown, Pa. *See page 60*

La Belle Iron Works, Steubenville, O.

Lukens Iron & Steel Co., Coatesville, Pa. *See page 61***PLATING DYNAMOS**

(See Generators, Low Voltage)

PLATINUM WAREEimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335***PLUGS****Fusible**

Boston Steam Specialty Co., 185 Franklin St., Boston, Mass.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Plouff Co., 1500 River St., Boston, Mass.

Spark

Belvidere Screw & Machine Co., Belvidere, Ill.

Hartford Machine Screw Co., Hartford, Conn.

PLUNGERS, CHILLED IRONEpping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286***PNEUMATIC CONVEYING SYSTEMS**

(See Conveying Systems, Pneumatic)

PNEUMATIC DESPATCH TUBES

(See Tubes, Pneumatic Despatch)

PNEUMATIC PUMPING SYSTEMS

(See Air Lift Pumping Systems)

POLE LINE SPECIALTIESDiamond Expansion Bolt Co., 90 West St., Cor. Cedar, New York, N. Y. *See page 262***POLISHING MACHINERY**

Blevney, John C., Newark, N. J.

Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.

Chase Turbine Mfg. Co., Orange, Mass.

Chicago Wheel & Mfg. Co., 1101-1103 W. Monroe St., Chicago, Ill.

Diamond Machine Co., 9 Coddling St., Providence, R. I.

Divine Bros. Co., Utica, N. Y.

Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.

Hemming Bros. Co., Inc., New Haven, Conn.

Rochester Motors Co., Inc., Rochester, N. Y.

*Rorysford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*

St. Louis Machine Tool Co., 2607 S. Broadway, St. Louis, Mo.

Webster & Perks Tool Co., Springfield, O.

Cutlery

Hemming Bros. Co., Inc., New Haven, Conn.

POLISHING WHEELS

Bickford & Francis Belting Co., Buffalo, N. Y.

PORCELAIN WAREAmerican Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334***PORTLAND CEMENT AND LIME PLANTS**

Fuller Engineering Co., Allentown, Pa.

PORTLAND CEMENT MACHINERY

Bonnot Co., Canton, O.

POTS

Cinder, Chemical Slag, Etc.

Bethlehem Foundry & Machine Co., South Bethlehem, Pa.

Erhart, Chris., 1237-41 Sixth Ave. West, Cincinnati, O.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Pot

See Catalogue Section for data of firms listed in bold face type

POTS (continued)

Galvanizing

Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. See page 30

Tinning

Marshall Foundry Co., 29th & Railroad Sts., Pittsburgh, Pa. See page 306

POTTERY MACHINERY

Patterson Foundry & Machine Co., East Liverpool, O.

POURING PLANTS, CONTINUOUS (Foundry)

Standard Sand & Machine Co., Cleveland O.

POWDERED COAL EQUIPMENT

Aero Pulverizer Co., 120 Broadway, New York, N. Y. See page 68

Bonnot Co., Canton, O.

Fuller Engineering Co., Allentown, Pa.

Johnson Engineering Works, 1734 First Natl. Bank Bldg., Chicago, Ill.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. See page 69

*Locomotive Pulverized Fuel Co., 30 Church St., New York, N. Y.

Metals Production Equipment Co., 105 W. 40th St., New York, N. Y.

Quigley Furnace Specialties Co., Inc., 26 Cortlandt St., New York, N. Y.

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

United Iron Works Co., Iola, Kan.

Worthington Pump & Mch. Corp'n (Power & Mining Mch. Works), 115 Broadway, New York, N. Y. See pages 26, 86, 276, 291

POWER TRANSMISSION MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Tool & Machine Co., 109 Beach St., Boston, Mass.

Bond Foundry & Machine Co., Manheim, Lancaster, Co., Pa.

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. See page 136

Brown Clutch Co., Sandusky, O.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. See page 174

*Chain Belt Co., 734 Park St., Milwaukee, Wis. See pages 176, 177

Cross Gear & Engine Co., 800-806 Bellevue Ave., Detroit, Mich.

Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147

Edgemont Machine Co., Dayton, O.

Ehrsam & Sons Mfg. Co., J. B., Enterprise, Tenn.

Falk Co., Milwaukee, Wis. See pages 138, 139

*Falls Clutch & Machinery Co., Cuyahoga Falls, O. See page 143

Franklin Machine Co., Providence, R. I.

*Hill Clutch Co., Cleveland, O. See page 148

Hodson, G. & A., 226 Arch St., Philadelphia, Pa.

*Holyoke Machine Co., Holyoke, Mass.

Horton Machine Works, Elmira, N. Y.

Hunt Machine Co., Rodney, Orange, Mass.

*Jeffrey Mfg. Co., 904 N. Fourth St., Columbus, O.

Jones & Laughlin Steel Co., Pittsburgh, Pa.

Keystone Pulley Co., Oneida, N. Y.

*Link-Belt Co., Chicago, Ill. See page 178

Meese & Gottfried Co., San Francisco, Cal.

Minster Machine Co., Minster, O.

*Moore & White Co., Philadelphia, Pa. See page 149

Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.

Naylor Bros., Peckskill, N. Y.

Nordyke & Marmon Co., Indianapolis, Ind.

Olmsted-Flint Co., 624 Main St., Cambridge, Mass.

Oneida Steel Pulley Co., 37 Cedar St., Oneida, N. Y.

Plamondon Mfg. Co., A., 24 N. Clinton St., Chicago, Ill.

Platt Iron Works, Dayton, O. See page 290

Poole Engineering & Machinery Co., Baltimore, Md.

Prybil Machine Co., P., 512-524 W. 41st St., New York, N. Y.

Reeves Pulley Co., Columbus, Ind.

*Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. See pages 152, 153

Savage Co., W. J., Knoxville, Tenn.

Sellers & Co., Inc., Wm., Philadelphia, Pa.

Tamaqua Mfg. Co., Tamaqua, Pa.

Thomas Coupling Co., Troy, Pa.

Union Iron Works, Decatur, Ill.

Webster Mfg. Co., Tiffin, O.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. See pages 180, 181, 182

*Wood's Sons Co., T. B., Chambersburg, Pa. See pages 150, 151

PRESSED STEEL PRODUCTS

(See Shapes, Pressed Steel)

PRESSES

Arbor

Atlas Press Co., 310 N. Park St., Kalamazoo, Mich. See page 217

Hannifin Mfg. Co., Chicago, Ill.

United Engine Mfg. Co., Hanover, Pa.

Baling

Acme Hydraulic Co., Milwaukee, Wis.

American Arbor Machine Co., Ann Arbor, Mich.

Boomer & Boschert Press Co., 331 W. Water St., Syracuse, N. Y.

Logemann Brothers Co., Milwaukee, Wis.

Blanking

Consolidated Press Co., Hastings, Mich.

Broaching

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. See page 212

Southwark Foundry & Machine Co., Philadelphia, Pa. See page 24

Draw

Niagara Machine & Tool Works, Buffalo, N. Y. See page 214

Drop

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. See page 212

Perkins Machine Co., Warren, Mass.

Drying

American Process Co., 68 William St., New York, N. Y.

Extruding

Robertson & Co., John, 133 Water St., Brooklyn, N. Y.

Southwark Foundry & Machine Co., Philadelphia, Pa. See page 24

Filter

Carbondale Machine Co., Carbondale, Pa. See page 307

Erhart, Chris., 1237-41 Sixth Ave. West, Cincinnati, O.

Kilby Mfg. Co., 4623 Lakeside Ave., Cleveland, O.

Platt Iron Works, Dayton, O. See page 290

Provost Engineering Corp'n, Eatle & Provost Sts., Brooklyn, N. Y.

Shriver & Co., T., 842 Hamilton St., Harrison, N. J.

Foot and Hand

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. See page 212

Kidder Mfg. Co., J. F., Burlington, Vt.

*Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. See pages 152, 153

V & O Press Co., (Glendale) Brooklyn, N. Y.

Forging

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. See page 212

Consolidated Press Co., Hastings, Mich.

Pot

Advertisements of firms marked * appear in The Journal, A. S. M. E.

United Engineering & Foundry Co., Farmers Bank Bldg., Pittsburgh, Pa.

Forging (Steam Hydraulic)

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Hydraulic

Acme Hydraulic Co., Milwaukee, Wis.

*Alliance Machine Co., Alliance, O. *See page 188*

Boomer & Boschert Press Co., 331 W. Water St., Syracuse, N. Y.

Burroughs Co., Charles, 141-149 Commerce St., Newark, N. J.

Chambersburg Engineering Co., Chambersburg, Pa.

Elmes Engineering Works, Charles F., 215 N. Morgan St., Chicago, Ill.

Epping Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

*Falls Clutch & Machinery Co., Cuyahoga Falls, O. *See page 143*

Hydraulic Press Mfg. Co., Mount Gilead, O.

Lowrie Mfg. Co., Springfield, Mass.

McCall Machine Works, Rochester, N. Y.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*

Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. *See page 297*

Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

Robertson & Co., John, 133 Water St., Brooklyn, N. Y.

Shriver & Co., T., 842 Hamilton St., Harrison, N. J.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Tod Co., William S., Phelps St., Youngstown, O.

Williams Foundry & Machine Co., Akron, O.

Williams, White & Co., Moline, Ill. *See page 215*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Inclinable

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Massillon Foundry & Machine Co., Massillon, O.

Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

Lead Encasing

Robertson & Co., John, 133 Water St., Brooklyn, N. Y.

Platen (Hydraulic)

McCall Machine Works, Rochester, N. Y.

Power

American Compressor & Pump Co., 801-5 E. Pratt St., Baltimore, Md.

Ams Machine Co., Max, Bridgeport, Conn.

Baird Machine Co., Bridgeport, Conn.

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Cleveland Machine & Mfg. Co., 4938-4952 Hamilton Ave., Cleveland, O.

Consolidated Press Co., Hastings, Mich.

Ferracute Machine Co., Bridgeton, N. J.

Heartley Machine, Variety Iron & Tool Works, 900-908 Summit St., Cor. Locust, Toledo, O.

Leffler & Co., Chas., 49-73 Clymer St., Brooklyn, N. Y.

Lucas Machine Tool Co., E. 99th St. & N. Y. C. R. R., Cleveland, O.

Manville Machine Co., E. J., Waterbury, Conn.

Massillon Foundry & Machine Co., Massillon, O.

Michigan Press Co., Ypsilanti, Mich.

Rockford Iron Works, Rockford, Ill.

Standard Machinery Co., Auburn, R. I.

V & O Press Co., (Glendale) Brooklyn, N. Y.

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

Willard Machine & Tool Co., Cincinnati, O.

Zeh & Hahemann Co., Avenue A. & Vanderpool St., Newark, N. J.

Printing

Whitlock Printing Press Mfg. Co., Derby, Conn.

Punching and Trimming

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Cleveland Punch & Shear Works Co., Cleveland, O.

Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.

Massillon Foundry & Machine Co., Massillon, O.

Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

Seattle-Astoria Iron Works, 601 Myrtle St., Seattle, Wash.

Zeh & Hahemann Co., Avenue A. & Vanderpool St., Newark, N. J.

Screw

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Boomer & Boschert Press Co., 331 W. Water St., Syracuse, N. Y.

Perkins Machine Co., Warren, Mass.

Philadelphia Drying Machinery Co., 6721 Germantown Ave., Philadelphia, Pa. *See page 297*

Stamping

McCall Machine Works, Rochester, N. Y.

Meriden Press & Drop Co., 153 State St., Meriden, Conn.

Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

Zeh & Hahemann Co., Avenue A. & Vanderpool St., Newark, N. J.

Steam Plate

Boomer & Boschert Press Co., 331 W. Water St., Syracuse, N. Y.

Sheet Metal Working

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

Perkins Machine Co., Warren, Mass.

Toledo Machine & Tool Co., Toledo, O.

Wheel (Hydraulic)

McCall Machine Works, Rochester, N. Y.

PRESSURE INDICATORS, REGULATORS, ETC.

(See Indicators, Regulators, etc., Pressure)

PRODUCERS, GAS

Chapman Engineering Co., Mt. Vernon, O.

Cooper Co., C. & G., Mt. Vernon, O.

*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*

Dornfeld Iron Works, Watertown, Wis.

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Milwaukee Reliance Boiler Works, Milwaukee, Wis.

Morgan Construction Co., Worcester, Mass.

Nelson Blower & Furnace Co., 11 Elkins St., Boston, Mass.

*Otto Gas Engine Works, Philadelphia, Pa.

*Smith Gas Engineering Co., Lexington, O.

Standard Gas Power Co., 17 Battery Place, New York, N. Y.

Syracuse Industrial Gas Co., 206 McCarthy Bldg., Syracuse, N. Y.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Pro

See Catalogue Section for data of firms listed in bold face type

PRODUCERS, GAS (continued)

- *Wood & Co., R. D., Philadelphia, Pa. See pages 204, 295
 Worthington Pump & Mch. Corp'n (Power & Mining Mch. Works), 115 Broadway, New York, N. Y. See pages 26, 86, 276, 291

Hand Operated

- Chapman Engineering Co., Mt. Vernon, O.
 Pressure Gas

- Amsler Gas Power Co., Wabash Bldg., Pittsburgh, Pa.

Suction Gas

- Amsler Gas Power Co., Wabash Bldg., Pittsburgh, Pa.
 Syracuse Industrial Gas Co., 206 McCarthy Bldg., Syracuse, N. Y.

PROFILING MACHINES

- Pratt & Whitney Co., Hartford, Conn.

PROPELLERS

- Evansville Gas Engine Works, 1230 Riverside Ave., Evansville, Ill.
 McNab Co., Bridgeport, Conn.
 Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.
 *Morris Machine Works, Baldwinsville, N. Y. See pages 288, 289

PROTECTIVE ARCH PLATES

- (See Arch Protectors, Boiler)

PULLEYS

Ball-Bearing

- Transmission Ball Bearing Co., Inc., 32 Wells St., Buffalo, N. Y.

Friction Clutch

- American Clutch Mfg. Co., 3541 Washington St., Boston, Mass.
 Brown Clutch Co., Sandusky, O.
 Conway & Co., Cincinnati, O.
 Dissinger & Bro., Inc., C. H. A., Wrightsville, Pa.
 Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147
 Eastern Machinery Co., New Haven, Conn.
 Fremont Clutch Co., Fremont, O.
 Hess-Snyder Co., Massillon, O.
 McMahon & Co., Worcester, Mass.
 O. K. Clutch & Machine Co., Second & Linden Sts., Columbia, Pa.
 Skillin & Richards Mfg. Co., 4520 Cortland St., Chicago, Ill.

Governor

- Brownwall Engine & Pulley Co., Holland, Mich.
 Reliance Engineering Co., Lansing, Mich.

Iron

- *Brown Co., A. & F., 79 Barclay St., New York, N. Y. See page 136
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. See page 174
 *Chain Belt Co., 734 Park St., Milwaukee, Wis. See pages 176, 177
 Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147
 Eagle Tool & Machine Co., 519-523 South Ave., N. S., Pittsburgh, Pa.
 *Falls Clutch & Machinery Co., Cuyahoga Falls, O. See page 143
 Hess-Snyder Co., Massillon, O.
 *Hill Clutch Co., Cleveland, O. See page 148
 Hodson, G. & A., 226 Arch St., Philadelphia, Pa.
 Medart Patent Pulley Co., St. Louis, Mo.
 Nordyke & Marmon Co., Indianapolis, Ind.
 Pyott Co., 955 Carroll Ave., Chicago, Ill.
 Standard Pulley Co., 1734 Powers St., Cincinnati, O.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. See pages 180, 181, 182
 *Wood's Sons Co., T. B., Chambersburg, Pa. See pages 150, 151

Iron (Cork-Insert)

- Cork Insert Co., 164 Federal St., Boston, Mass.

Motor

- Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147
 Erie Clutch & Pulley Co., 1906 Holland St., Erie, Pa.
 Olney & Warren, 406-412 Broome St., New York, N. Y.
 Saginaw Mfg. Co., Saginaw, Mich.

Paper

- Rockford Mfg. Co., Indianapolis, Ind.

Steel

- American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa. See page 142
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. See page 174
 Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147
 Keystone Pulley Co., Oneida, N. Y.
 Oneida Steel Pulley Co., 37 Cedar St., Oneida, N. Y.
 Philips Pressed Steel Pulley Works, Chestnut Hill, Philadelphia, Pa.

Wood

- *Caldwell & Son Co., H. W., 17th St & Western Ave., Chicago, Ill. See page 174
 Detroit Wood Pulley Co., 1331-1337 Bellevue Ave., Detroit, Mich.
 Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147
 Keasey Mfg. Co., Fostoria, O.
 Keystone Pulley Co., Oneida, N. Y.
 Ohio Valley Pulley Works, Inc., Maysville, Ky.
 Oneida Wood Pulley Co., Oneida, N. Y.
 Reading Wood Pulley Co., 11th & Muhlenberg Sts., Reading, Pa.
 Reeves Pulley Co., Columbus, Ind.
 Saginaw Mfg. Co., Saginaw, Mich.

Wood (Iron Center)

- Dodge Sales & Engineering Co., Mishawaka, Ind. See pages 74, 144, 145, 146, 147
 Erie Clutch & Pulley Co., 1906 Holland St., Erie, Pa.
 Saginaw Mfg. Co., Saginaw, Mich.

PULLEY COVERING

- (See Coverings, Pulley)

PULVERIZERS

- Abbé Engineering Co., 220 Broadway, New York, N. Y.
 Aero Pulverizer Co., 120 Broadway, New York, N. Y. See page 68
 *Brown Co., A. & F., 79 Barclay St., New York, N. Y. See page 136
 Gruendler Patent Crusher & Pulverizer Co., 928 N. First St., St. Louis, Mo.
 Hardinge Conical Mill Co., 120 Broadway, New York, N. Y.
 Johnson Engineering Works, 1734 First Natl. Bank Bldg., Chicago, Ill.
 Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. See page 69
 Mashek Engineering Co., 90 West St., New York, N. Y.
 Pennsylvania Crusher Co., Stephen Girard Bldg., Philadelphia, Pa.
 Raymond Bros. Impact Pulverizer Co., 1319 N. Branch St., Chicago, Ill.
 Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.
 Sturtevant Mill Co., Harrison Sq., Boston, Mass.
 Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. See pages 302, 303

Cement Materials

- Bradley Pulverizer Co., Boston, Mass.

Coal

- Bradley Pulverizer Co., Boston, Mass.

Pro

Limestone

Bradley Pulverizer Co., Boston, Mass.

Phosphate Rock

Bradley Pulverizer Co., Boston, Mass.

Refractory Materials

Bradley Pulverizer Co., Boston, Mass.

PULVERIZING AND AIR SEPARATING MACHINERY

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

PUMP GOVERNORS, VALVES, ETC.

(See Governors, Valves, etc., Pump)

PUMPING ENGINES

(See Engines, Pumping)

PUMPING OUTFITS

Domestic Engine & Pump Co., Shippensburg, Pa.

Fuller & Johnson Mfg. Co., Madison, Wis.

Ideal Engine Co., Lansing, Mich.

Mietz Machine Works, August, 123 Mott St., New York, N. Y. *See page 27*

Novo Engine Co., Lansing, Mich.

Rider-Ericsson Engine Co., 20 Murray St., New York, N. Y.

Standard Pump & Engine Co., Akron, O.

Universal Motor Co., Oshkosh, Wis.

PUMPS**Air**Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

McGowan Co., John H., Cincinnati, O.

Manistee Iron Works Co., Manistee, Mich. *See page 287*Platt Iron Works, Dayton, O. *See page 290**Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283*

Weber Subterranean Pump Co., 90 West St., New York, N. Y.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Laidlaw Works, Henry R. Worthington), 115 Broadway, New York, N. Y.

Air Lift Separator

Indiana Air Pump Co., 812 Indiana Pythian Bldg., Indianapolis, Ind.

AmmoniaCarbondale Machine Co., Carbondale, Pa. *See page 307**Veeder Mfg. Co., Hartford, Conn. *See page 341*Worthington Pump & Mch. Corp'n (Blake-Knowles Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291***Beer**

Lobee Pump & Machinery Co., Dearborn & Bridge, Buffalo, N. Y.

Bilge (Rotary)

Blackmer Rotary Pump Co., Petoskey, Mich.

Boiler Feed

Advance Pump & Compressor Co., Battle Creek, Mich.

American Steam Pump Co., Battle Creek, Mich.

Binghamton Machine Works, 38 Chenango St., Binghamton, N. Y.

Boys-Porter & Co., Connellsville, Pa.

Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*

*Davidson Co., M. T., 43 Keap St., Brooklyn, N. Y.

Deming Co., Salem, O. *See page 285*

DuBois Iron Works, DuBois, Pa.

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

Erwin & Co., 3734-3736 Cottage Grove Ave., Chicago, Ill.

Gardner Governor Co., Quincy, Ill. *See page 274*

McGowan Co., John H., Cincinnati, O.

Manistee Iron Works Co., Manistee, Mich. *See page 287*

Park Mfg. Co., Charlotte, N. C.

Platt Iron Works, Dayton, O. *See page 290*

Rumsey Pump Co., Ltd., Seneca Falls, N. Y.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Wagener Steam Pump Co., Canton, O.

Wilson-Snyder Mfg. Co., Pittsburgh, Pa.

Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Deane Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291***Centrifugal**

Adkins, Young & Allen Co., 561 W. Washington Blvd., Chicago, Ill.

Advance Pump & Compressor Co., Battle Creek, Mich.

Alberger Pump & Condenser Co., 140 Cedar St., New York, N. Y.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Steam Pump Co., Battle Creek, Mich.

American Well Works, Aurora, Ill.

Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*

Carthage Machine Co., Carthage, N. Y.

Columbus Steam Pump Works Co., P. O. Box 394, Columbus, O.

Dallett, W. P., 49 N. Seventh St., Philadelphia, Pa.

Dayton-Dick Co., Quincy, Ill.

De Laval Steam Turbine Co., Trenton, N. J.

D'Olier Centrifugal Pump & Machine Co., Morris Bldg., Philadelphia, Pa.

Earle Gear & Machine Co., Philadelphia, Pa.

Economy Pumping Machinery Co., 116-118 N. Carpenter St., Chicago, Ill.

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

Erie Pump & Equipment Co., Erie, Pa.

Erwin & Co., 3734-3736 Cottage Grove Ave., Chicago, Ill.

*Goulds Mfg. Co., Seneca Falls, N. Y.

Hill Pump Co., Anderson, Ind.

Kingsford Foundry & Machine Works, Oswego, N. Y.

*Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill. *See page 293*

Lawrence Machine Co., Lawrence, Mass.

Lawrence Pump & Engine Co., Lawrence, Mass.

Lea-Courtenay Co., Newark, N. J.

Lobee Pump & Machinery Co., Dearborn & Bridge, Buffalo, N. Y.

Manistee Iron Works Co., Manistee, Mich. *See page 287**Morris Co., I. P., Philadelphia, Pa. *See page 296**Morris Machine Works, Baldwinsville, N. Y. *See pages 288, 289*Platt Iron Works, Dayton, O. *See page 290*

Price Pump & Engine Co., G. W., 33 Stevenson St., San Francisco, Cal.

Rumsey Pump Co., Ltd., Seneca Falls, N. Y.

Savage & Love Co., Rockford, Ill.

Scranton Pump Co., Scranton, Pa.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Standard Pump & Engine Co., Akron, O.

Taber Pump Co., 291 Elm St., Buffalo, N. Y.

Terry Steam Turbine Co., Hartford, Conn.

Turbine Equipment Co., 50 Church St., New York, N. Y.

United Iron Works, Oakland, Cal.

Union Steam Pump Co., Battle Creek, Mich.

Weinman Pump Mfg. Co., Columbus, O.

*Westinghouse Electric & Mfg Co., East Pittsburgh, Pa.

Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85***Pum***See Catalogue Section for data of firms listed in bold face type*

PUMPS (continued)

Centrifugal

Wilson-Snyder Mfg. Co., Pittsburgh, Pa.
 *Wood & Co., R. D., Philadelphia, Pa. See
 pages 294, 295
 Worthington Pump & Mch. Corp'n (Jeaneville Works), 115 Broadway, New York, N. Y.
 See pages 26, 86, 276, 291

Chemical (Rotary)

Blackmer Rotary Pump Co., Petoskey, Mich.
 Condensation (with Automatic Receivers)
 Economy Pumping Machinery Co., 116-118
 N. Carpenter St., Chicago, Ill.
 Gardner Governor Co., Quincy, Ill. See
 page 274
 Platt Iron Works, Dayton, O. See page 290
 Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Henry R. Worthington),
 115 Broadway, New York, N. Y. See
 pages 26, 86, 276, 291

Dash Board (Automobile)

National Gauge & Equipment Co., La Crosse,
 Wis.

Deep Well

American Steam Pump Co., Battle Creek,
 Mich.
 American Wall Works, Aurora, Ill.
 Cameron Steam Pump Works, A. S., 11 Broad-
 way, New York, N. Y. See page 284
 Darling Pump & Mfg. Co., Ltd., Williamsport,
 Pa. See page 92
 Dayton Pump & Mfg. Co., Dayton, O.
 Deming Co., Salem, O. See page 285
 Douglas, W. & B., Middletown, Conn.
 Epping-Carpenter Pump Co., Pittsburgh, Pa.
 See page 286
 Hill Pump Co., Anderson, Ind.
 Indiana Air Pump Co., 812 Indiana Pythian
 Bldg., Indianapolis, Ind.
 Keystone Driller Co., Beaver Falls, Pa.
 McGowan Co., John H., Cincinnati, O.
 *Morris Machine Works, Baldwinsville, N. Y.
 See pages 288, 289
 Platt Iron Works, Dayton, O. See page 290
 Weinman Pump Mfg. Co., Columbus, O.
 Worthington Pump & Mch. Corp'n (Deane
 Works, Henry R. Worthington), 115 Broad-
 way, New York, N. Y. See pages 26, 86,
 276, 291

Diaphragm

Rumsey Pump Co., Ltd., Seneca Falls, N. Y.

Dredging

*Morris Machine Works, Baldwinsville, N. Y.
 See pages 288, 289
 *Wood & Co., R. D., Philadelphia, Pa. See
 pages 294, 295
 Worthington Pump & Mch. Corp'n (Henry
 R. Worthington), 115 Broadway, New
 York, N. Y. See pages 26, 86, 276, 291

Dry Vacuum

(See Pumps, Vacuum)

Electric

Boys-Porter & Co., Connelisville, Pa.
 Cameron Steam Pump Works, A. S., 11 Broad-
 way, New York, N. Y. See page 284
 Chandler Pump Co., Cedar Rapids, Ia.
 Chicago Pump Co., 904-10 W. Lake St.,
 Chicago, Ill.
 Dallett, W. P., 49 N. Seventh St., Philadelphia,
 Pa.
 Deming Co., Salem, O. See page 285
 Domestic Engine & Pump Co., Shippensburg,
 Pa.
 Douglas, W. & B., Middletown, Conn.
 Economy Pumping Machinery Co., 116-118
 N. Carpenter St., Chicago, Ill.
 Epping-Carpenter Pump Co., Pittsburgh, Pa.
 See page 286
 Erwin & Co., 3734-3736 Cottage Grove Ave.,
 Chicago, Ill.
 *Goulds Mfg. Co., Seneca Falls, N. Y.

Kerr Machinery & Supply Co., Kerr Bldg.,
 Detroit, Mich.

Lawrence Machine Co., Lawrence, Mass.
 Lawrence Pump & Engine Co., Lawrence,
 Mass.

McGowan Co., John H., Cincinnati, O.
 *Morris Machine Works, Baldwinsville, N. Y.
 See pages 288, 289

Peters Pump Co., Kewanee, Ill.
 Pittsburgh Machine Tool Co., Braddock, Pa.
 See pages 219, 292

Platt Iron Works, Dayton, O. See page 290
 Pneumatic Machine Co., Syracuse, N. Y.
 Quimby, Inc., William E., 548 W. 23rd St.,
 New York, N. Y.

Sandusky Foundry & Machine Co., Sandusky,
 O.

Scranton Pump Co., Scranton, Pa.
 Standard Pump & Engine Co., Akron, O.
 Wilson-Snyder Mfg. Co., Pittsburgh, Pa.

*Wood & Co., R. D., Philadelphia, Pa. See
 pages 294, 295
 Worthington Pump & Mch. Corp'n (Deane
 Works), 115 Broadway, New York, N. Y.
 See pages 26, 86, 276, 291

Yeomans Bros. Co., 231 Institute Place, Chi-
 cago, Ill.

Elevator

American Steam Pump Co., Battle Creek,
 Mich.
 Epping-Carpenter Pump Co., Pittsburgh, Pa.
 See page 286

McGowan Co., John H., Cincinnati, O.
 Worthington Pump & Mch. Corp'n (Fred
 M. Prescott Works), 115 Broadway, New
 York, N. Y. See pages 26, 86, 276, 291

Fire

Hartford Machine Screw Co., Hartford, Conn.
 Hunt Machine Co., Rodney, Orange, Mass.
 Lea-Courtenay Co., Newark, N. J.

Lucas-Miner Pumps Co., Springfield, O.

Gas Power

Humphrey Pump Construction Co., Youngs-
 town, O.

Hand

Deming Co., Salem, O. See page 285
 Rumsey Pump Co., Ltd., Seneca Falls, N. Y.

Hydraulic Pressure

Acme Hydraulic Co., Milwaukee, Wis.
 American Steam Pump Co., Battle Creek,
 Mich.

Bagley & Sewall Co., Watertown, N. Y.
 Burroughs Co., Charles, 141-149 Commerce
 St., Newark, N. J.

Cameron Steam Pump Works, A. S., 11 Broad-
 way, New York, N. Y. See page 284
 Elmes Engineering Works, Charles R., 215
 N. Morgan St., Chicago, Ill.

Epping-Carpenter Pump Co., Pittsburgh, Pa.
 See page 286

Hydraulic Press Mfg. Co., Mount Gilead, O.
 *Morris Machine Works, Baldwinsville, N. Y.
 See page 288, 289

Olsen Testing Machine Co., Tinian, 500 N.
 12th St., Philadelphia, Pa. See page 312

Platt Iron Works, Dayton, O. See page 290
 Riehle Bros. Testing Machine Co., 1424 N.
 9th St., Philadelphia, Pa. See page 313

Robertson & Co., John, 133 Water St., Brook-
 lyn, N. Y.

Sandusky Foundry & Machine Co., Sandusky,
 O.

Wilson-Snyder Mfg. Co., Pittsburgh, Pa.
 *Wood & Co., R. D., Philadelphia, Pa. See
 pages 294, 295

Worthington Pump & Mch. Corp'n (Blake-
 Knowles Works, Henry R. Worthington),
 115 Broadway, New York, N. Y. See
 pages 26, 86, 276, 291

Lift and Force

Myers & Bro., F. E., Ashland, O.
 Ottumwa-Moline Engine & Pump Co.,
 802-822 Madison Ave., Ottumwa, Ia.

Pum

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Measuring (Gasoline or Oil)

Dayton Pump & Mfg. Co., Dayton, O.
Wayne Oil Tank & Pump Co., Fort Wayne, Ind.

Mine

Boytz-Porter & Co., Connellsville, Pa.
Crawford & McCrimmon Co., Brazil, Ind.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Prescott Co., Menominee, Mich.
Weinman Pump Mfg. Co., Columbus, O.
Wilson-Snyder Mfg. Co., Pittsburgh, Pa.

Oil

American Oil Pump & Tank Co., Central & Kindel Ave., Cincinnati, O.
Atlas Brass Foundry Co., 980 S. Front St., Columbus, O.
Blackmer Rotary Pump Co., Petoskey, Mich.
Bowser & Co., Inc., S. F., Ft. Wayne, Ind.
Butler Mfg. Co., Kansas City, Mo.
Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*
Deming Co., Salem, O. *See page 285*
Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
Inter-State Machine Products Co., 58 Allen St., Rochester, N. Y.
May-Nelson Mfg. Co., 1202 F St., Washington, D. C.
National Transit Pump & Machine Co., Oil City, Pa.
Platt Iron Works, Dayton, O. *See page 290*
*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*
*Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283*
Trahern Pump Co., 707 S. Main St., Rockford, Ill.
Wagener Steam Pump Co., Canton, O.
Wilson-Snyder Mfg. Co., Pittsburgh, Pa.
*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*
Worthington Pump & Mch'y. Corp'n (Blake-Knowles Works, Snow Plant, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Oil (Force Feed)

Detroit Lubricator Co., Detroit, Mich. *See page 125*
*Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*
Hills-McCanna Co., 153 W. Kinzie St., Chicago, Ill.
McCord Mfg. Co., Detroit, Mich. *See page 127*
McCullough Mfg. Co., 2632-2634 Central Ave., Minneapolis, Minn.
Madison-Kipp Lubricator Co., Madison, Wis. *See page 128*
Manzel Brothers Co., 315 Babcock St., Buffalo, N. Y.
*Pickering Governor Co., Portland, Conn. *See page 131*
*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*
Sherwood Mfg. Co., Buffalo, N. Y.

Oil (Hand)

American Injector Co., Detroit, Mich. *See page 116*
Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*
Michigan Lubricator Co., 661-701 Beaubien St., Detroit, Mich.
*Royersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*

Pneumatic Pressure

Chandler Pump Co., Cedar Rapids, Ia.
Latta-Martin Pump Co., Hickory, N. C.

Power

Advance Pump & Compressor Co., Battle Creek, Mich.

American Steam Pump Co., Battle Creek, Mich.

Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*
Columbus Steam Pump Works Co., P. O. Box 394, Columbus, O.

Dallett, W. P., 49 N. Seventh St., Philadelphia, Pa.

Dayton Pump & Mfg. Co., Dayton, O.
Dean Bros. Steam Pump Works, Indianapolis, Ind.

Deming Co., Salem, O. *See page 285*

Douglas, W. & B., Middletown, Conn.

DuBois Iron Works, DuBois, Pa.

Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*

Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

Gardner Governor Co., Quincy, Ill. *See page 274*

*Goulds Mfg. Co., Seneca Falls, N. Y.

Lawrence Pump & Engine Co., Lawrence, Mass.

Lucas-Miner Pumps Co., Springfield, O.

McDonald Mfg. Co., A. Y., Dubuque, Ia.

McGowan Co., John H., Cincinnati, O.

Mast Foss & Co., Springfield, O.

Matson Machine Co., Concord, N. H.

Myers & Bro., F. E., Ashland, O.

National Transit Pump & Machine Co., Oil City, Pa.

Peters Pump Co., Kewanee, Ill.

Platt Iron Works, Dayton, O. *See page 290*

Rumsey Pump Co., Ltd., Seneca Falls, N. Y.

Sandusky Foundry & Machine Co., Sandusky, O.

Steiner & Co., M., 242 S. Torrence St., Dayton, O.

Union Steam Pump Co., Battle Creek, Mich.

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Worthington Pump & Mch'y. Corp'n (Deane Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Rotary

Blackmer Rotary Pump Co., Petoskey, Mich.
Connersville Blower Co., Connersville, Ind.
Holland Machine Co., 90 W. Broadway, New York, N. Y.

*Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill. *See page 293*

Lobee Pump & Machinery Co., Dearborn & Bridge, Buffalo, N. Y.

Manistee Iron Works Co., Manistee, Mich. *See page 287*

Nash Engineering Co., South Norwalk, Conn.

Pittsburgh Machine Tool Co., Braddock, Pa. *See pages 219, 292*

*Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283*

Rumsey Pump Co., Ltd., Seneca Falls, N. Y.

Taber Pump Co., 291 Elm St., Buffalo, N. Y.

Traher Pump Co., 707 S. Main St., Rockford, Ill.

Screw

Quimby, Inc., William E., 548 W. 23rd St., New York, N. Y.

Sewage

Kingsford Foundry & Machine Works, Oswego, N. Y.

Latta-Martin Pump Co., Hickory, N. C.

*Morris Machine Works, Baldwinsville, N. Y. *See pages 288, 289*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Soap (Rotary)

Blackmer Rotary Pump Co., Petoskey, Mich.

Spray

Deming Co., Salem, O. *See page 285*

See Catalogue Section for data of firms listed in bold face type

PUMPS (continued)**Steam**

- Adkins, Young & Allen Co., 561 W. Washington Blvd., Chicago, Ill.
 Advance Pump & Compressor Co., Battle Creek, Mich.
 Blake Pump & Condenser Co., Fitchburg, Mass.
 Blakeslee Mfg. Co., Du Quoin, Ill.
 Columbus Steam Pump Works Co., P. O. Box 394, Columbus, O.
 *Davidson Co., M. T., 43 Keap St., Brooklyn, N. Y.
 Dean Bros. Steam Pump Works, Indianapolis, Ind.
 Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
 Furness Bros. Co., 1815 W. Walnut St., Chicago, Ill.
 Gardner Governor Co., Quincy, Ill. *See page 274*
 Guild & Garrison, 463 Kent Ave., Brooklyn, N. Y.
 Hall Steam Pump Co., Pittsburgh, Pa.
 Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.
 Hill Pump Co., Anderson, Ind.
 Lucey Mfg. Corp'n of Texas, 308 Texas Co. Bldg., Houston, Texas
 McGowan Co., John H., Cincinnati, O.
 *Morris Machine Works, Baldwinsville, N. Y. *See pages 288, 289*
 National Foundry & Machine Co., 1406 W. Main St., Louisville, Ky.
 National Transit Pump & Machine Co., Oil City, Pa.
 Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
 Platt Iron Works, Dayton, O. *See page 290*
 Pulsometer Steam Pump Co., 485 S. 21st St., Irvington, N. J.
 Rearick, Charles B., 14 Wall St., New York, N. Y.
 Scranton Pump Co., Scranton, Pa.
 Union Steam Pump Co., Battle Creek, Mich.
 Wagener Steam Pump Co., Canton, O.
 Walker Mfg. Co., Fenton, Mich.
 Wells Steam Pump Co., F. C., 101 S. Clinton St., Chicago, Ill.
 Wheeler Condenser & Engineering Co., Carteret, N. J.
 Wilson-Snyder Mfg. Co., Pittsburgh, Pa.
 Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Sugar House

- American Steam Pump Co., Battle Creek, Mich.
 Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
 Union Steam Pump Co., Battle Creek, Mich.
 Worthington Pump & Mch. Corp'n (Blake-Knowles Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Tank

- American Steam Pump Co., Battle Creek, Mich.
 Boyts-Porter & Co., Connellsville, Pa.
 Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
 Gardner Governor Co., Quincy, Ill. *See page 274*
 Lucas-Miner Pumps Co., Springfield, O.
 Myers & Bro., F. E., Ashland, O.
 Platt Iron Works, Dayton, O. *See page 290*
 Quimby, Inc., William E., 548 W. 23rd St., New York, N. Y.
 *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*
 Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Deane Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Turbine

- Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*
 Chicago Pump Co., 904-10 W. Lake St., Chicago, Ill.
 Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
 Kerr Machinery & Supply Co., Kerr Bldg., Detroit, Mich.
 Kingsford Foundry and Machine Works, Oswego, N. Y.
 *Morris Machine Works, Baldwinsville, N. Y. *See pages 288, 289*
 Platt Iron Works, Dayton, O. *See page 290*
 Rearick, Charles B., 14 Wall St., New York, N. Y.
 Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
 *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*
 Worthington Pump & Mch. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Vacuum

- American Steam Pump Co., Battle Creek, Mich.
 Beach-Russ Co., 220 Broadway, New York, N. Y.
 Bishop-Babcock-Becker Co., Cleveland, O.
 Buffalo Foundry & Machine Co., E. Ferry St. & Fillmore Ave., Buffalo, N. Y.
 Bury Compressor Co., Erie, Pa.
 Cameron Steam Pump Works, A. S., 11 Broadway, New York, N. Y. *See page 284*
 Clark & Norton Mfg. Co., Wellsville, N. Y.
 Clothel Co., 61 Broadway, New York, N. Y.
 Crowell Mfg. Co., 298 Taaffe Place, Brooklyn, N. Y.
 Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
 Economy Pumping Machinery Co., 116-118 N. Carpenter St., Chicago, Ill.
 Epping-Carpenter Pump Co., Pittsburgh, Pa. *See page 286*
 Guild & Garrison, 463 Kent Ave., Brooklyn, N. Y.
 Hall Steam Pump Co., Pittsburgh, Pa.
 Hubbard's Sons, Norman, 265 Water St., Brooklyn, N. Y.
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 *Lammert & Mann Co., Wood & Walnut Sts., Chicago, Ill. *See page 293*
 Lopee Pump & Machinery Co., Dearborn & Bridge, Buffalo, N. Y.
 Manistee Iron Works Co., Manistee, Mich. *See page 287*
 May-Nelson Mfg. Co., 1202 F St., Washington, D. C.
 Nash Engineering Co., South Norwalk, Conn.
 Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
 Platt Iron Works, Dayton, O. *See page 290*
 Pulsometer Steam Pump Co., 485 S. 21st St., Irvington, N. J.
 *Roots Co., P. H. & F. M., Connersville, Ind. *See pages 282, 283*
 Sandusky Foundry & Machine Co., Sandusky, O.
 Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*
 Worthington Pump & Mch. Corp'n (Blake-Knowles Works, Deane Works, Laidlaw Works, Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*
 York Electric & Machine Co., 30-34 N. Penn St., York, Pa.

Water Works

(See Engines, Pumping)

Well (Centrifugal Type)

Getty, Fred I., Jennings, La.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Windmill

Chandler Pump Co., Cedar Rapids, Ia.
 Peters Pump Co., Kewanee, Ill.
 Trahern Pump Co., 707 S. Main St., Rockford,
 Ill.

PUNCH PRESS SAFETY DEVICES

Benjamin Electric Mfg. Co., 120-128 S.
 Sangamon St., Chicago, Ill.

PUNCHES**Hydraulic**

*Alliance Machine Co., Alliance, O. *See page 188*
 Williams, White & Co., Moline, Ill. *See page 215*
 *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Metal (Hand Power)

Armstrong-Blum Mfg. Co., 339 N. Francisco
 Ave., Chicago, Ill.
 Whitney Metal Tool Co., Rockford, Ill.

Multiple

Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Long & Allstatter Co., Hamilton, O. *See page 213*
 Niagara Machine & Tool Works, Buffalo,
 N. Y. *See page 214*
 Standard Bridge Tool Co., 1226 Fulton Bldg.,
 Pittsburgh, Pa.
 Williams, White & Co., Moline, Ill. *See page 215*
 *Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Power

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y.
See page 212
 Covington Machine Co., 14 Wall St., New
 York, N. Y.
 Ferracute Machine Co., Bridgeton, N. J.
 Ironton Punch & Shear Co., Ironton, O.
 Long & Allstatter Co., Hamilton, O. *See page 213*
 Niagara Machine & Tool Works, Buffalo,
 N. Y. *See page 214*
 Slater, Marsden & Whittemore Co., Beloit,
 Wis.
 Slocumb & Co., Inc., F. F., Wilmington, Del.
 Williams, White & Co., Moline, Ill. *See page 215*

PUNCHES AND DIES

Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Cleveland Punch & Shear Works Co., Cleve-
 land, O.
 Nestor Mfg. Co., 40 W. 13th St., New York,
 N. Y.
 *Roryersford Foundry & Machine Co., 52 N.
 5th St., Philadelphia, Pa. *See pages 152, 153*
 Sloan & Chace Mfg. Co., Ltd., 6th Ave.,
 Cor. N. 13th St., Newark, N. J. *See page 233*
 Williams, White & Co., Moline, Ill. *See page 215*

PUNCHING AND COPING MACHINES

Long & Allstatter Co., Hamilton, O. *See page 213*
 Williams, White & Co., Moline, Ill. *See page 215*

PUNCHING AND SHEARING MACHINES

*Alliance Machine Co., Alliance, O. *See page 188*
 Badger State Machine Co., Janesville, Wis.
 Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Clark Foundry Co., Rumford, Me.
 Covington Machine Co., 14 Wall St., New
 York, N. Y.
 Garrison Foundry Co., A., Pittsburgh, Pa.
 Hilles & Jones Co., Wilmington, Del.
 Long & Allstatter Co., Hamilton, O. *See page 213*

Massillon Foundry & Machine Co., Massillon,
 O.

New Doty Mfg. Co., Janesville, Wis.

Niagara Machine & Tool Works, Buffalo, N. Y.
See page 214

Pels & Co., Henry, 90 West St., New York,
 N. Y.

Rock River Machine Co., Janesville, Wis.

*Roryersford Foundry & Machine Co., 52 N.
 5th St., Philadelphia, Pa. *See pages 152, 153*

Slater, Marsden & Whittemore Co., Beloit,
 Wis.

Williams, White & Co., Moline, Ill. *See page 215*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

PURIFIERS, FEED WATER

(See Heaters and Purifiers, Feed Water)

PYROMETERS (Indicating, Recording)

Brown Instrument Co., Philadelphia, Pa.
See page 328

Eimer & Amend, 205-211 Third Ave., New
 York, N. Y. *See page 335*

*Foxboro Co., Foxboro, Mass.

Holz, Herman A., 50 Church St., New York,
 N. Y.

Locomotive Superheater Co., 30 Church St.,
 New York, N. Y.

Morse Thermo-Gage Co., Inc., Ithaca, N. Y.

Queen-Gray Co., 616-620 Chestnut St., Phila-
 delphia, Pa.

Schaeffer & Budenberg Mfg. Co., Brooklyn,
 N. Y. *See page 329*

Shore Instrument & Mfg. Co., Inc., 557 W.
 22nd St., New York, N. Y.

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*

Thwing Instrument Co., 436 N. 5th St.,
 Philadelphia, Pa. *See page 332*

Uehling Instrument Co., 2011 Empire Bldg.,
 New York, N. Y. *See page 321*

Wilson-Maule Co., 781 E. 142nd St., New
 York, N. Y.

Electric

*Bristol Co., Waterbury, Conn. *See page 327*

Brown Instrument Co., Philadelphia, Pa. *See page 328*

Eimer & Amend, 205-211 Third Ave., New
 York, N. Y. *See page 335*

Engelhard, Charles, 30 Church St., New York,
 N. Y.

Holz, Herman A., 50 Church St., New York,
 N. Y.

Hoskins Mfg. Co., 453-471 Lawton Ave.,
 Detroit, Mich.

Leeds & Northrup Co., Philadelphia, Pa.

Schaeffer & Budenberg Mfg. Co., Brooklyn,
 N. Y. *See page 329*

Tagliabue Mfg. Co., C. J., 18-88 33rd St.,
 Brooklyn, N. Y. *See page 330*

*Taylor Instrument Cos., Rochester, N. Y.
See page 331

Thwing Instrument Co., 436 N. 5th St., Phila-
 delphia, Pa. *See page 332*

Optical

Gibb Instrument Co., Highland Bldg., Pitts-
 burgh, Pa.

Morse Thermo-Gage Co., Inc., Ithaca, N. Y.

Shore Instrument & Mfg. Co., Inc., 557 W.
 22nd St., New York, N. Y.

Zaubitz, August, 95-97 Cliff St., New York,
 N. Y.

Pneumatic

Uehling Instrument Co., 2011 Empire Bldg.,
 New York, N. Y. *See page 321*

Radiation

Brown Instrument Co., Philadelphia, Pa.
See page 328

Eimer & Amend, 205-211 Third Ave., New
 York, N. Y. *See page 335*

Tagliabue Mfg. Co., C. J., 18-88 33rd St.,
 Brooklyn, N. Y. *See page 330*

See Catalogue Section for data of firms listed in bold face type

PYROMETERS (Indicating, Recording) (continued)

Radiation

*Taylor Instrument Cos., Rochester, N. Y. See page 331

Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. See page 332

PYROMETRY, POTENTIOMETER SYSTEM OF

Leeds & Northrup Co., Philadelphia, Pa.

PYROXYLIN MACHINERY

Burroughs Co., Charles, 141-149 Commerce St., Newark, N. J.

Q

QUARRY MACHINERY

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. See pages 272, 273

QUARTZ GLASS

Eimer & Amend, 205-211 Third Ave., New York, N. Y. See page 335

R

RACKS, MACHINE CUT

Ganschow Co., William, Chicago, Ill.
Grant Gear Works, 151 Pearl St., Boston, Mass.

Nuttall Co., R. D., Pittsburgh, Pa.

Van Dorn & Dutton Co., Cleveland, O.

RACKS, METAL

Durand Steel Locker Co., 76 W. Monroe St., Chicago, Ill.

Barrel Storage

Economy Engineering Co., 415 S. Washtenaw Ave., Chicago, Ill.

RADIATORS, STEAM AND WATER

American Radiator Co., Chicago, Ill.
Gurney Heater Mfg. Co., 200 Franklin St., Boston, Mass.

Kewanee Boiler Co., Kewanee, Ill.

Lord & Burnham Co., Irvington on Hudson, New York, N. Y.

*Smith Co., H. B., Westfield, Mass. See pages 308, 309

United States Radiator Corp'n, Detroit, Mich.

RADIATOR TRAPS

(See Traps, Radiator)

RAIL BOND TESTERS

Thompson-Levering Co., 323 Arch St., Philadelphia, Pa.

RAIL JOINTS

(See Joints, Rail)

RAIL SAWS, PORTABLE

Industrial Works, Bay City, Mich. See page 189

RAILINGS, PIPE

Pancoast Co., Henry B., 243 & 245 So. 3rd St., Philadelphia, Pa.

RAILROAD SUPPLIES

American Steel Foundries, 1163 McCormick Bldg., Chicago, Ill.

Craghead Engineering Co., 340-342 Main St., Cincinnati, O.

Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.

Somers, Fidler & Todd Co., 327 Water St., Pittsburgh, Pa.

RAILROAD TRACK SCALES

(See Scales, Railroad Track)

RAILS

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. See page 196

Electric Railways

Bethlehem Steel Co., South Bethlehem, Pa.

Standard Section

Bethlehem Steel Co., South Bethlehem, Pa.
Lackawanna Steel Co., Lackawanna, N. Y.

RAILWAYS

Cable and Automatic

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. See pages 186, 187

Industrial

Atlas Car & Mfg. Co., Cleveland, O.

Chase Foundry & Mfg. Co., Columbus, O.

Easton Car & Construction Co., Easton, Pa.

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. See pages 186, 187

*Link-Belt Co., Chicago, Ill. See page 178

Orenstein-Arthur Koppel Co., Canton, O.

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. See page 196

Turl Iron & Car Co., Inc., 50 Broad St., New York, N. Y.

Washburn & Granger, 50 Church St., New York, N. Y. See page 72

RAMMERS, FOUNDRY

Cleveland Pneumatic Tool Co., 6410 Hawthorne Ave., Cleveland, O.

Dayton Pneumatic Tool Co., Dayton, O.

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. See pages 272, 273

Oldham & Son Co., Geo., 4316 Tackawanna St., Frankford, Philadelphia, Pa.

RAMS, HYDRAULIC

Deming Co., Salem, O. See page 285

Niagara Hydraulic Engine Co., Chester, Pa.

Rife Engine Co., Trinity Bldg., 111 Broadway, New York, N. Y.

Worthington Pump & Mch'y. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. See pages 26, 86, 276, 291

REAMERS

Brubaker & Bros., W. L., 50 Church St., New York, N. Y.

Cleveland Twist Drill Co., Cleveland, O.

Conant & Donelson Co., Conway, Mass.

Detroit Twist Drill Co., 634-646 Fort West, Detroit, Mich.

*Greenfield Tap and Die Corp'n, Greenfield, Mass.

Hughes Tool Co., Houston, Texas

Kelly Reamer Co., 1555 Columbus Road, Cleveland, O.

Lincoln-Williams Twist Drill Co., Taunton, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

Toledo Drill & Tool Co., Toledo, O.

Whitman & Barnes Mfg. Co., Akron, O.

Adjustable and Expansion

American Specialty Co., 29 East Madison St., Chicago, Ill.

Chadwick & Trefethen, 32 Bow St., Portsmouth, N. H.

Kelly Reamer Co., 1555 Columbus Road, Cleveland, O.

McCrosky Reamer Co., Meadville, Pa. See pages 246, 247

Schellenbach-Kuntz Tool Co., 120 Opera Place, Cincinnati, O.

Standard Tool Co., Cleveland, O.

Electric

Van Dorn Electric Tool Co., Cleveland, O. See page 141

Pyr

RECEIVERS, AIR

- Bury Compressor Co., Erie, Pa.
 Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
 Frost Mfg. Co., Galesburg, Ill.
 Gardner Governor Co., Quincy, Ill. *See page 274*
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. *See page 50*
 National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*
 Nordberg Mfg. Co., Milwaukee, Wis. *See page 17*
 Norwalk Iron Works Co., So. Norwalk, Conn. *See page 275*
 *Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*
 Ruemmeli-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.
 Worthington Pump & Mch. Corp'n (Laidlaw Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

RECORDING INSTRUMENTS

(See Instruments, Recording)

RECOVERY SYSTEMS (Solids from Fumes or Dust)

- Clark Dust Collecting Co., 1116 Fisher Bldg., Chicago, Ill.

RED LEAD

- National Lead Co., 111 Broadway, New York, N. Y. *See pages 260, 261*

REELS, METAL

- American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa. *See page 142*
 Mossberg Co., Frank, Attleboro, Mass.

REFRACTORIES

- Carborundum Co., Niagara Falls, N. Y. *See page 248*
 Hoskins Mfg. Co., 453-471 Lawton Ave., Detroit, Mich.
 Norton Co., Worcester, Mass. *See page 249*

REFRIGERATING MACHINERY

- Armstrong Machinery Co., 3201-3219 East Riverside, Spokane, Wash.
 Arctic Ice Machine Co., Canton, O.
 Automatic Refrigerating Co., Hartford, Conn.
 Baker Ice Machine Co., Omaha, Neb.
 Brunswick Refrigerating Co., 5021-7 So. State St., Chicago, Ill.
 Buffalo Refrigerating Machine Co., 126 Liberty St., New York, N. Y.
 Carbondale Machine Co., Carbondale, Pa. *See page 307*
 Clothel Co., 61 Broadway, New York, N. Y.
 *De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*
 Frick Co., Waynesboro, Pa.
 Hallam, F. W., 80 Stanhope St., Brooklyn, N. Y.
 Kroeschell Bros. Ice Machine Co., 472 W. Erie St., Chicago, Ill.
 *Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
 Mayer Ice Machine & Engineering Co., Morris St. & Hudson River, Jersey City, N. J.
 National Foundry & Machine Co., 1406 W. Main St., Louisville, Ky.
 Niebling Co., F. W., Cincinnati, O.
 Phoenix Ice Machine Co., 2711 Church Ave., Cleveland, O.
 Portsmouth Engine Co., Portsmouth, O.
 Remington Machine Co., Wilmington, Del.
 Ruemmeli-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.
 Triumph Ice Machine Co., Cincinnati, O.
 United Iron Works, Oakland, Cal.
 United Iron Works Co., Springfield, Mo.
 Vesterdahl & Co., Karl, 90 West St., New York, N. Y.
 *Vilter Mfg. Co., 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*

- Vogt Machine Co., Henry, Louisville, Ky. *See page 55*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
 York Mfg. Co., York, Pa.

Automatic

- Automatic Refrigerating Co., Hartford, Conn.

REGULATORS**Blower**

- D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 108*
 Foster Engineering Co., Newark, N. J. *See page 109*

Damper

- Berry Engineering Co., Chester, Pa.
 Burrows Mfg. Co., 41-45 N. Water St., York, Pa.
 *Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.
 *Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo. *See page 319*
 D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 108*
 Eastwood Wire Mfg. Co., Belleville, N. J.
 Foskett & Bishop Co., New Haven, Conn.
 Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*
 Kitts Steam Specialty Co., 60 E. 1st St., Oswego, N. Y.
 Locke Regulator Co., Salem, Mass.
 Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*
 McDonough Automatic Regulator Co., Detroit, Mich.
 Spencer Regulator Co., Salem, Mass.
 Standard Regulator Co., 286 South St., Newark, N. J.
 Thompson & Co., Richard, 126 Liberty St., New York, N. Y.
 Watts Regulator Co., 250-252 Lowell St., Lawrence, Mass.

Draft (House Furnace)

- Altroy Mfg. Co., 1234 Harvard St., Washington, D. C.

Electric

- *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Feed Water

- *Almy Water Tube Boiler Co., Providence, R. I. *See page 33*
 Berry Engineering Co., Chester, Pa.
 Burrows Mfg. Co., 41-45 N. Water St., York, Pa.
 Cade Co., H. E., 104 S. 4th St., Philadelphia, Pa.
 Central Machine Co., 7th, Wood & Franklin Sts., Philadelphia, Pa.
 Chaplin-Fulton Mfg. Co., 28-34 Penn Ave., Pittsburgh, Pa.
 Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass. *See page 324*
 Erie Pump & Equipment Co., Erie, Pa.
 Hobson, Russell B., 455 Kessel Ave., New Brighton, N. Y.
 Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*
 Kitts Mfg. Co., 19-21 W. Seneca St., Oswego, N. Y.
 Kitts Steam Specialty Co., 60 E. 1st St., Oswego, N. Y.
 McDonough Automatic Regulator Co., Detroit, Mich.
 National Regulator Co., 208 S. Jefferson St., Chicago, Ill.
 Plant Engineering & Equipment Co., Inc., 6 Church St., New York, N. Y.
 Plouff Co., 1500 River St., Boston, Mass.

Feed Water

- Ray Mfg. Co., Louisville, Ky.

Reg

See Catalogue Section for data of firms listed in bold face type

REGULATORS (continued)**Feed Water**

"S-C" Regulator Co., Fostoria, O.
 Sorge, Jr. & Co., A., Monadnock Block,
 Chicago, Ill.
 Steam Equipment Mfg. Co., 8077 Jenkins
 Arcade Bldg., Pittsburgh, Pa.
 Williams Gauge Co., 543 Fourth Ave., Pitts-
 burgh, Pa.

Pressure

*Crane Co., 836 S. Michigan Ave., Chicago,
 Ill. *See pages 88, 89, 90, 91*
 D'Este Co., Julian, 26 Canal St., Boston,
 Mass. *See page 108*
 Dunham Co., C. A., Marshalltown, Ia. *See*
pages 112, 113
 Foster Engineering Co., Newark, N. J. *See*
page 109
 Kitts Mfg. Co., 19-21 W. Seneca St., Oswego,
 N. Y.
 Klipfel Mfg. Co., 2651-59 W. Harrison St.,
 Chicago, Ill.
 Leslie Co., Lyndhurst, N. J. *See page 111*
 Locke Regulator Co., Salem, Mass.
 Mason Regulator Co., Boston, Mass.
 Messer & Co., 121 N. Seventh St., Phila-
 delphia, Pa.
 Ohio Brass Co., Mansfield, O.
 Plouff Co., 1500 River St., Boston, Mass.
 Tagliabue Mfg. Co., C. J., 18-88 33rd St.,
 Brooklyn, N. Y. *See page 330*
 *Taylor Instrument Cos., Rochester, N. Y.
See page 331
 Watts Regulator Co., 250-252 Lowell St.,
 Lawrence, Mass.

Pump

(See Governors, Pump)

Temperature

American Thermostat Co., 101 Mechanic St.,
 Newark, N. J.
 Automatic Steam Trap Specialty Co., 2707
 Vestry Ave., Cleveland, O.
 *Bristol Co., Waterbury, Conn. *See page 327*
 D'Este Co., Julian, 26 Canal St., Boston,
 Mass. *See page 108*
 Hornung, J. C., 343 S. Dearborn St., Chicago,
 Ill.
 Jewell Mfg. Co., Auburn, N. Y.
 Johnson Service Co., Milwaukee, Wis.
 Kieley & Mueller, Inc., 34 W. 13th St., New
 York, N. Y. *See page 110*
 Klipfel Mfg. Co., 2651-59 W. Harrison St.,
 Chicago, Ill.
 Powers Regulator Co., 5 South Wabash Ave.,
 Chicago, Ill.
 Roys Heat Control Co., 915 Gates Ave.,
 Brooklyn, N. Y.
 *Sarco Co., Inc., Woolworth Bldg., New York,
 N. Y.
 Standard Regulator Co., 286 South St.,
 Newark, N. J.
 Tagliabue Mfg. Co., C. J., 18-88 33rd St.,
 Brooklyn, N. Y. *See page 330*
 *Taylor Instrument Cos., Rochester, N. Y.
See page 331
 Thwing Instrument Co., 436 N. 5th St., Phila-
 delphia, Pa. *See page 332*

Water Level

Erie Pump & Equipment Co., Erie, Pa.

REPAIR WORK**Elevator**

American Electric Machine & Elevator Co.,
 1706 N. 12th St., St. Louis, Mo.
 Roberts Elevator Co., James H., 430 West
 Broadway, New York, N. Y.

Engine (Emergency)

*Harris-Corliss Engine & Machine Co., Provi-
 dence, R. I. *See page 15*
 Hartford Engine Works, 223 State St., Hart-
 ford, Conn.
 Waters Co., Geo. H., Mariners Harbor, N. Y.
 Wendland Engrg. & Const. Co., C. F., 63
 Wooster St., New York, N. Y.

General Machine

Central Machine Co., 7th, Wood & Franklin
 Sts., Philadelphia, Pa.
 Eagle Tool & Machine Co., 519-523 South
 Ave., N. S., Pittsburgh, Pa.

Marine

Valk & Murdoch Co., Charleston, S. C.

RESAWS**Band**

West Coast Iron Works, 4601-9 14th Ave.,
 N. W., Seattle, Wash.

Slab (Horizontal)

Mereen-Johnson Machine Co., Minneapolis,
 Minn.

Vertical

Mereen-Johnson Machine Co., Minneapolis,
 Minn.

RESERVOIRS, AERATING

*Spray Engineering Co., 93 Federal St., Boston,
 Mass. *See page 87*

RESTS, SLIDE

Mann, Charles A., 166 Doyle Ave., Provi-
 dence, R. I.

RETAINERS, BALL

Bearings Co. of America, Lancaster, Pa.
 Nice Ball Bearing Co., Land Title Bldg.,
 Philadelphia, Pa.

RETORTS, COAL GAS

United Gas Improvement Co., Broad & Arch
 Sts., Philadelphia, Pa.

REVERSING GEAR (Power-Locomotive)

Economy Devices Corp'n, 30 Church St.,
 New York, N. Y.

REVOLUTION COUNTERS

(See Counters, Revolution)

REVOLUTION RECORDERS

Crosby Steam Gage & Valve Co., 40 Central
 St., Boston, Mass. *See page 324*

Uhling Instrument Co., 2011 Empire Bldg.,
 New York, N. Y. *See page 321*

RICE MILLING MACHINERY

Barnard & Seas Mfg. Co., Moline, Ill.
 Sprout Waldron & Co., Muncy, Pa.
 Squier Mfg. Co., Geo. L., Buffalo, N. Y.

RIDDLES AND SIEVES

Buffalo Wire Works Co., 480 Terrace, Buffalo,
 N. Y.

RIFLING MACHINES

Pratt & Whitney Co., Hartford, Conn.

RINGS (Weldless)

Hay-Budden Mfg. Co., 254 N. Henry St.,
 Brooklyn, N. Y.

RIVET SETS

Dayton Pneumatic Tool Co., Dayton, O.

RIVETERS**Hydraulic**

*Alliance Machine Co., Alliance, O. *See page*
188
 Southwark Foundry & Machine Co., Phila-
 delphia, Pa. *See page 24*
 *Wood & Co., R. D., Philadelphia, Pa. *See*
pages 294, 295

Pneumatic

Allen Co., John F., 370-372 Gerard Ave.,
 New York, N. Y.
 Grant Mfg. & Machine Co., Bridgeport, Conn.
 *Ingersoll-Rand Co., 11 Broadway, New York,
 N. Y. *See pages 272, 273*

Vibrating

Grant Mfg. & Machine Co., Bridgeport, Conn.

RIVETING MACHINES

High Speed Hammer Co., Rochester, N. Y.
 Long & Allstatter Co., Hamilton, O. *See*
page 213
 Standard Mfg. Co., Bridgeport, Conn.
 Townsend Mfg. Co., H. P., Hartford, Conn.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Williams, White & Co., Moline, Ill. *See page 215*

Electric

Eveland Engineering & Mfg. Co., Drexel Bldg., Philadelphia, Pa.
Thomson Electric Welding Co., Lynn, Mass. *See page 242*
 Toledo Electric Welder Co., Cincinnati, O.

RIVETS

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*
 American Screw Co., Providence, R. I.
Blake & Johnson Co., Waterbury, Conn. *See page 235*
Champion Rivet Co., Cleveland, O. *See page 255*
 Falls Rivet Co., Kent, O.
 National Bolt & Nut Co., 62nd St., & A. V. R. R., Pittsburgh, Pa.
 Ohio Nut & Bolt Co., Beria, O.
 Pittsburgh Screw & Bolt Co., Preble Ave., Pittsburgh, Pa.
 Progressive Mfg. Co., Torrington, Conn.
 Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*
 Upson Nut Co., Cleveland, O.

Boiler and Tank

Champion Rivet Co., Cleveland, O. *See page 255*

Structural Steel

Champion Rivet Co., Cleveland, O. *See page 255*
 Garland Nut & Rivet Co., West Pittsburgh, Pa.

ROAD MAKING MACHINERY

Barber Asphalt Paving Co., Philadelphia, Pa.
 Good Roads Machinery Co., Fort Wayne, Ind.

ROCK BITS

Hughes Tool Co., Houston, Texas

RODS

Brass

Chase Rolling Mill Co., Waterbury, Conn.
 Rutter, Arthur T., 256-257 Broadway, New York, N. Y.
 Scoville Mfg. Co., Waterbury, Conn.

Conduit

Diamond Expansion Bolt Co., 90 West St. Cor. Cedar, New York, N. Y. *See page 262*

Drill

Carpenter Steel Co., Reading, Pa.
 Central Steel & Wire Co., 119 N. Peoria St., Chicago, Ill.
 Halcomb Steel Co., Syracuse, N. Y.
 Hobson, Houghton & Co., Ltd., 83 Beekman St., New York, N. Y.
 Pittsburgh Tool Steel Wire Co., Monaca, Pa.
 Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. *See page 210*

Fibre

***American Vulcanized Fibre Co., Wilmington, Del.** *See page 203*
Diamond State Fibre Co., Bridgeport, Pa.

Upset

Bayonne Bolt & Nut Co., Bayonne, N. J.
 Pittsburgh Screw & Bolt Co., Preble Ave., Pittsburgh, Pa.

ROLL GRINDING

Detroit Tool Co., Detroit, Mich.

ROLLER BEARINGS

(See Bearings, Roller)

ROLLERS (Cylindrical)

Ball & Roller Bearing Co., Maple Ave., Danbury, Conn.

ROLLING MILL MACHINERY

***Alliance Machine Co., Alliance, O.** *See page 188*

Blake & Johnson Co., Waterbury, Conn. *See page 235*

Garrison Foundry Co., A., Pittsburgh, Pa.
***Mackintosh, Hemphill & Co., 12th & Etna Sts., Pittsburgh, Pa.**

***Mesta Machine Co., Pittsburgh, Pa.**
 Morgan Construction Co., Worcester, Mass.
***Morgan Engineering Co., Alliance, O.**
 Poole Engineering & Machine Co., Baltimore, Md.

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

Standard Engineering Co., Ellwood City, Pa.
 Standard Machinery Co., Auburn, R. I.
 Tod Co., William S., Phelps St., Youngstown, O.

Torrington Mfg. Co., Torrington, Conn. *See page 240*

Treadwell Engineering Co., 140 Cedar St., New York, N. Y.

Wheeling Mold & Foundry Co., Pittsburgh, Pa.
 Youngstown Engineering Co., Youngstown, O.
 Youngstown Foundry & Machine Co., Youngstown, O.

ROLLING PARTITIONS

(See Partitions, Rolling)

ROLLS

Bending

Badger State Machine Co., Janesville, Wis.
 Covington Machine Co., 14 Wall St., New York, N. Y.
 Hilles & Jones Co., Wilmington, Del.
 Ironton Punch & Shear Co., Ironton, O.
 Long & Allstatter Co., Hamilton, O. *See page 213*

New Doty Mfg. Co., Janesville, Wis.
Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

Rock River Machine Co., Janesville, Wis.
 Slater, Marsden & Whittemore Co., Beloit, Wis.

Wicks Bros., 512 Water St., Saginaw, Mich.
Williams, White & Co., Moline, Ill. *See page 215*

Calendar

Perkins & Son, Inc., B. F., Holyoke, Mass.

Crushing

Buchanan Co., Inc., C. G., 90 West St., New York, N. Y.
 Traylor Engineering & Mfg. Co., Allentown, Pa.
Worthington Pump & Mch. Corp'n (Power & Mining Mch. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Forging

Ajax Mfg. Co., Cleveland, O.
 Philadelphia Roll & Machine Co., 25th & Washington Ave., Philadelphia, Pa.
Williams, White & Co., Moline, Ill. *See page 215*

Rubber

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
***Goodrich Co., B. F., Akron, O.** *See pages 133, 165*

Sand, Chilled and Steel

Farrel Foundry & Machine Co., Ansonia, Conn.
 Garrison Foundry Co., A., Pittsburgh, Pa.
 Lobdell Car Wheel Co., Wilmington, Del.
***Mackintosh, Hemphill & Co., 12th & Etna Sts., Pittsburgh, Pa.**
 Seaman-Sleeth Co., 41st St. & A. V. R. R., Pittsburgh, Pa.
 Standard Engineering Co., Ellwood City, Pa.
 Wheeling Mold & Foundry Co., Pittsburgh, Pa.
 Youngstown Foundry & Machine Co., Youngstown, O.

Roll

See Catalogue Section for data of firms listed in bold face type

ROLLS (continued)**Straightening**

Ironton Punch & Shear Co., Ironton, O.
New Doty Mfg. Co., Janesville, Wis.

ROOFING (Prepared)

Barrett Co., 17 Battery Place, New York, N. Y.
Carey Co., Philip, Cincinnati, O. *See page 121*
*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*
*Texas Co., 17 Battery Pl., New York, N. Y. *See page 124*

ROOFING AND SIDING, ASBESTOS

Asbestos Protected Metal Co., 1st Natl. Bank Bldg., Pittsburgh, Pa.
*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

ROPE**Hoisting**

*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
Durable Wire Rope Co., 93 Pearl St., Boston, Mass.
*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
Leschen & Sons Rope Co., A., St. Louis, Mo.
*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*

Lead

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Manila

American Mfg. Co., Noble & West Sts., Brooklyn, N. Y.
Columbian Rope Co., Auburn, N. Y.
Waterbury Co., 63 Park Row, New York, N. Y.

Transmission

American Mfg. Co., Noble & West Sts., Brooklyn, N. Y.
*Caldwell & Son Co., C. H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
Columbian Rope Co., Auburn, N. Y.
Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*
Durable Wire Rope Co., 93 Pearl St., Boston, Mass.
*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Wire

American Hoist & Derrick Co., St. Paul, Minn.
American Steel & Wire Co., 72 W. Adams St., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. *See page 190*
Durable Wire Rope Co., 93 Pearl St., Boston, Mass.
Hazard Mfg. Co., Wilkes-Barre, Pa.
Hegeman & Ward, 43 South St., New York, N. Y.
Leschen & Sons Rope Co., A., St. Louis, Mo.
Macomber & Whyte Rope Co., Kenosha, Wis.
*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*
Rogers Wire Works, Inc., 291 Broadway, New York, N. Y.
Waterbury Co., 63 Park Row, New York, N. Y.
Wright Wire Co., Worcester, Mass.

ROPE DRESSING

Cling Surface Co., Buffalo, N. Y.

ROPE DRIVES

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*
*Falls Clutch & Machinery Co., Cuyahoga Falls, O. *See page 143*
*Hill Clutch Co., Cleveland, O. *See page 148*
Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*
*Wood's Sons Co., T. B., Chambersburg, Pa. *See pages 150, 151*

ROUTING MACHINES

Royle & Sons, John, Paterson, N. J.

RUBBER CLOTH

Consolidated Rubber Co., P. O. Box 86, Trenton, N. J.

RUBBER GOODS**Hard**

India Rubber Co., New Brunswick, N. J.
Stokes Rubber Co., Joe., Trenton, N. J.

Laboratory

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*

Mechanical

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
Boston Woven Hose & Rubber Co., Box 5077, Boston, Mass.
Consumers Rubber Co., 829 Superior Ave., W., Cleveland, O.
"Double Service" Packing Co., 246 Chestnut St., Philadelphia, Pa.
*Goodrich Co., B. F., Akron, O. *See pages 133, 165*
Goodyear Tire & Rubber Co., Akron, O.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind.
*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*
Maguire Rubber Co., 30 Church St., New York, N. Y.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Mechanical Rubber Co., Cleveland, O. *See page 169*
*Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.
Republic Rubber Co., Youngstown, O.
Revere Rubber Co., Chelsea, Mass.
Salisbury & Co., W. H., 105-107 S. Wabash Ave., Chicago, Ill.

RUBBER MILL MACHINERY

Day Co., J. H., Cincinnati, O.
Farrel Foundry & Machine Co., Ansonia, Conn.
Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

RUBBER TUBING MACHINERY

Royle & Sons, John, Paterson, N. J.

S**SACCHAROMETERS**

Wagner, Carl H., 1944 N. Albany Ave., Chicago, Ill.

SADDLES, PRESSED STEEL (Boiler)

Lukens Iron & Steel Co., Coatesville, Pa. *See page 61*

SAFETY DEVICES

Buffalo Wire Works Co., 480 Terrace, Buffalo, N. Y.
Fiske Iron Works, J. W., 78-80 Park Place, New York, N. Y.

Abrasive Wheel

Webster & Perks Tool Co., Springfield, O.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Elevator

Maintenance Co., 417-421 Canal St., New York, N. Y.
 Wheeler-McDowell Elevator Co., 417 Canal St., New York, N. Y.

Punching Press

Benjamin Electric Mfg. Co., 120-128 S. Sangamon St., Chicago, Ill.

SALT MAKING MACHINERY

Willcox Engineering Co., Saginaw, Mich.
See page 317

SAND, FIRE

Carborundum Co., Niagara Falls, N. Y. *See page 248*

SAND BLAST APPARATUS

American Foundry Equipment Co., 52 Vanderbilt Ave., New York, N. Y.
 *De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 Macleod Co., Cincinnati, O.
 Pangborn Corp'n, Hagerstown, Md.
 Sand Mixing Machine Co., 52 Vanderbilt Ave., New York, N. Y.
 Tilgham-Brooksbank Sand Blast Co., 1124 S. 11th St., Philadelphia, Pa.

SAND BLAST ROOMS (Rotary Table)

American Foundry Equipment Co., 52 Vanderbilt Ave., New York, N. Y.

SAND CUTTING MACHINERY

Sand Mixing Machine Co., 52 Vanderbilt Ave., New York, N. Y.

SAND TEMPERING MACHINERY

Sand Mixing Machine Co., 52 Vanderbilt Ave., New York, N. Y.

SANDERS, LOCOMOTIVE

U. S. Metallic Packing Co., 429 North 13th St., Philadelphia, Pa.

SASH**Continuous**

Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

Steel

Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

SASH OPERATING DEVICES

Drouve Co., G., 40 Drouve St., Bridgeport, Conn.
 Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

SAW BLADES, HACK

Atkins & Co., Inc., E. C., Indianapolis, Ind.
 Massachusetts Saw Works, Springfield, Mass.
 Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.
 Racine Tool & Machine Co., Racine, Wis.
 Simonds Mfg. Co., Fitchburg, Mass.
 Thompson & Son Co., Henry G., New Haven, Conn.
 West Haven Mfg. Co., New Haven, Conn.

SAW FRAMES, HACK

Atkins & Co., Inc., E. C., Indianapolis, Ind.
 Badger Gas & Gasoline Engine Co., Kansas City, Kans.
 Thompson & Son Co., Henry G., New Haven, Conn.
 West Haven Mfg. Co., New Haven, Conn.

SAW MILL MACHINERY

Bay City Foundry & Machine Co., Bay City, Mich.
 Bretting Mfg. Co., C. G., Ashland, Wis.
 Clark Bros. Co., Olean, N. Y.
 Enterprise Co., Columbiana, O.
 Filer & Stowell Co., Milwaukee, Wis.
 Garland Co., M., Bay City, Mich.
 Iddell Co., Charlotte, N. C.
 Lyon Iron Works, Greene, N. Y.
 Phoenix Mfg. Co., Eau Claire, Wis.
 Prescott Co., Menominee, Mich.

Sinker Davis Co., Indianapolis, Ind.
 Union Iron Wks., 15 Oak St., Bangor, Me.

SAW SHARPENING MACHINES

Cochrane-Bly Co., Rochester, N. Y.
SAWS

Band (Power)

Armstrong-Blum Mfg. Co., 339 N. Francisco Ave., Chicago, Ill.
 Disston & Sons, Inc., Henry, Philadelphia, Pa.
 Racine Tool & Machine Co., Racine, Wis.
 Silver Mfg. Co., Salem, O.
 Sinker Davis Co., Indianapolis, Ind.

Circular (Metal)

Cochrane-Bly Co., Rochester, N. Y.
 Disston & Sons, Inc., Henry, Philadelphia, Pa.
 Higley Machine Co., Singer Bldg., New York, N. Y.
 Hunter Saw & Machine Co., 57th & Butler Sts., Pittsburgh, Pa.
 Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.
 Peerless Machine Co., Racine, Wis.
 Simonds Mfg. Co., Fitchburg, Mass.

Circular (Metal, Inserted Tooth)

Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.

Grooving

Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.

Hack (Power)

Armstrong-Blum Mfg. Co., 339 N. Francisco Ave., Chicago, Ill.
 Atkins & Co., Inc., E. C., Indianapolis, Ind.
 Massachusetts Saw Works, Springfield, Mass.
 Myers Machine Tool Co., Columbia, Pa.
 Racine Tool & Machine Co., Racine, Wis.
 Robertson Machine & Foundry Co., W., 58 Rano St., Buffalo, N. Y.
 Thompson & Son Co., Henry G., New Haven, Conn.
 West Haven Mfg. Co., New Haven, Conn.
 Western Tool & Mfg. Co., Springfield, O.

Hack (Power-Automatic)

Armstrong-Blum Mfg. Co., 339 N. Francisco Ave., Chicago, Ill.

Rip

Woods Engineering Co., 108 Patterson St., Alliance, O.

SCALE BEAMS

Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y. *See page 314*
 Chatillon & Sons, John, 85-93 Cliff St., New York, N. Y. *See page 315*

SCALES

Torsion Balance Co., 92 Reade St., New York, N. Y.

Automatic

American Kron Scale Co., 430 E. 53rd St., New York, N. Y.
 Automatic Weighing Machine Co., 134-140 Commerce St., Newark, N. J.
 Richardson Scale Co., Passaic, N. J.
 Sturtevant Mill Co., Harrison Sq., Boston, Mass.

Conveyor

Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*
 Electric Weighing Co., 180 13th Ave., New York, N. Y.

Dormant

Buffalo Scale Co., Inc., 1200 Niagara St., Buffalo, N. Y. *See page 314*

Fluid Pressure

Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass. *See page 324*

See Catalogue Section for data of firms listed in bold face type

SCALES (continued)

Industrial Railway

Buffalo Scale Co., Inc., 1200 Niagara St.,
Buffalo, N. Y. *See page 314*

Mine Tipple

Streeter-Amet Weighing & Recording Co.,
4101-5 Ravenswood Ave., Chicago, Ill.

Monorail

Buffalo Scale Co., Inc., 1200 Niagara St.,
Buffalo, N. Y. *See page 314*

Platform

Buffalo Scale Co., Inc., 1200 Niagara St.,
Buffalo, N. Y. *See page 314*

Chatillon & Sons, John, 85-93 Cliff St., New
York, N. Y. *See page 315*

Howe Scale Co. of N. Y., 341 Broadway,
New York, N. Y.

Jones of Binghamton, Inc., Binghamton,
N. Y.

Standard Scale & Supply Co., Pittsburgh, Pa.

Railroad Track

Buffalo Scale Co., Inc., 1200 Niagara St.,
Buffalo, N. Y. *See page 314*

Streeter-Amet Weighing & Recording Co.,
4101-5 Ravenswood Ave., Chicago, Ill.

Wagon

Jones of Binghamton, Inc., Binghamton,
N. Y.

SCLEROSCOPES (Hardness Tester)

Holz, Herman A., 50 Church St., New York,
N. Y.

Shore Instrument & Mfg. Co., Inc., 557 W.
22nd St., New York, N. Y.

SCREENS

Flume

Hunt Machine Co., Rodney, Orange, Mass.

Perforated Metal

Harrington & King Perforating Co., 619 N.
Union Ave., Chicago, Ill.

Hendrick Mfg. Co., Dundaff St., Carbondale,
Pa.

Revolving

*Caldwell & Son Co., H. W., 17th St. &
Western Ave., Chicago, Ill. *See page 174*

*Chain Belt Co., 734 Park St., Milwaukee,
Wis. *See pages 176, 177*

Dull Co., Raymond W., 111 W. Washington
St., Chicago, Ill.

*Jeffrey Mfg. Co., 904 N. Fourth St., Columbus,
O.

*Link-Belt Co., Chicago, Ill. *See page 178*
Stedmans Foundry & Machine Works, Aurora,
Ind.

Weller Mfg. Co., 1820-1856 N. Kostner Ave.,
Chicago, Ill. *See pages 180, 181, 182*

Williams Patent Crusher & Pulverizer Co.,
Old Colony Bldg., Chicago, Ill. *See pages*
302, 303

Shaking

*Caldwell & Son Co., H. W., 17th St. &
Western Ave., Chicago, Ill. *See page 174*

*Chain Belt Co., 734 Park St., Milwaukee,
Wis. *See pages 176, 177*

Colorado Iron Works Co., Box 989, Denver,
Colo.

Holmes & Bros., Rob't, Danville, Ill.

*Link-Belt Co., Chicago, Ill. *See page 178*
Sturtevant Mill Co., Harrison Sq., Boston,
Mass.

Williams Patent Crusher & Pulverizer Co.,
Old Colony Bldg., Chicago, Ill. *See pages*
302, 303

Traveling

*Chain Belt Co., 734 Park St., Milwaukee,
Wis. *See pages 176, 177*

*Link-Belt Co., Chicago, Ill. *See page 178*

Well

Getty, Fred I., Jennings, La.

Wire

Michigan Wire Cloth Co., 536 Howard St.,
Detroit, Mich.

Wood Chips

Carthage Machine Co., Carthage, N. Y.

SCREW CUTTING DIES

(See Dies, Thread Cutting)

SCREW DRIVING MACHINES

Reynolds Pattern & Machine Co., 101-103
Third Ave., Moline, Ill.

Electric

Neil & Smith Electric Tool Co., 120-2 E.
6th St., Cincinnati, O.

SCREW JACKS

(See Jacks, Screw)

SCREW MACHINE PRODUCTS

Atlas Brass Foundry Co., 980 S. Front St.,
Columbus, O.

Babson-Dow Mfg. Co., 60 Fulda St., Rox-
bury Station, Boston, Mass.

Ball & Roller Bearing Co., Maple Ave., Dan-
bury, Conn.

Belvidere Screw & Machine Co., Belvidere,
Ill.

Blake & Johnson Co., Waterbury, Conn.
See page 235

Brown Bag Filling Machine Co., Fitchburg,
Mass.

Chicago Automatic Machine Co., 400-408 N.
Oakley Blvd., Chicago, Ill.

Chicago Screw Co., 1020 S. Homan Ave.,
Chicago, Ill.

Cincinnati Screw Co., Twilight, Ohio.

Corbin Screw Corp'n, Division American
Hardware Corp'n, New Britain, Conn.

Defiance Screw Machine Products Co., 731
Perry St., Defiance, O.

Detroit Screw Works, Detroit, Mich.

Eastern Machine Screw Corp., New Haven,
Conn.

Fostoria Screw Co., Fostoria, O.

Hanson Bros., Plainville, Conn.

Hartford Machine Screw Co., Hartford,
Conn.

Mehl Machine, Tool & Die Co., Roselle, N. J.
See pages 238, 239

Meisel Press Mfg. Co., 950 Dorchester, Ave.,
Boston, Mass.

Millholland Machine Co., W. K., Indianapolis,
Ind.

Moore, George W., 44 Farnsworth St., Bos-
ton, Mass.

National-Acme Mfg. Co., Cleveland, O. *See*
pages 226, 227

Nelson Mfg. Co., A., 564-572 W. Randolph
St., Chicago, Ill.

New Haven Screw Co., 191-193 Foster St.,
New Haven, Conn.

Phillips Mfg. Co. R. B., 3 Grand St. Ct.,
Worcester, Mass.

Ramsdell Specialty Co., 679 W. Boylston St.,
Worcester, Mass.

Rutter, Arthur T., 256-257 Broadway, New
York, N. Y.

Sabin Machine Co., Cleveland, O.

Shimer & Sons, Samuel J., Milton, Pa.

U. S. Automatic Co., 524 Rockefeller Bldg.,
Cleveland, O.

Weiss, Louis T., 286 Taaffe Place, Brooklyn,
N. Y.

Western Automatic Machine Screw Co.,
Elyria, O.

Wicaco Screw & Machine Works, Inc., 625-29
Wood St., Philadelphia, Pa.

Worcester Machine Screw Co., Worcester,
Mass.

SCREW MACHINES

Acme Machine Tool Co., Cincinnati, O. *See*
page 218

Bardons & Oliver, 1133 W. 9th St., Cleveland,
Ohio.

Cleveland Automatic Machine Co., 2260
Ashland Road, Cleveland, O.

Sca

Dresses Machine Tool Co., 225-239 W. McMicken Ave., Cincinnati, O.
 Foster Machine Co., Elkhart, Ind.
 Garvin Machine Co., Spring & Varick Sts., New York, N. Y.
 *Jones & Lamson Machine Co., Springfield, Vt. See pages 220, 221, 222, 223
 Millholland Machine Co., W. K., Indianapolis, Ind.
 Pratt & Whitney Co., Hartford, Conn.
 Smurr & Kamen Co., 313 N. Whepple St., Chicago, Ill.
 Wachs Co., E. H., 1525 Dayton St., Chicago, Ill.
 *Warner & Swasey Co., Cleveland, O. See page 225
 Wells & Son Co., F. E., Greenfield, Mass.
 Wood Turret Machine Co., Brazil, Ind.

Automatic

Chicago Automatic Machine Co., 400-408 N. Oakley Blvd., Chicago, Ill.
 Cleveland Automatic Machine Co., 2269 Ashland Road, Cleveland, O.
 National-Acme Mfg. Co., Cleveland, O. See pages 226, 227
 Townsend Mfg. Co., H. P., Hartford, Conn.

Automatic, Multiple Spindle

Cincinnati Planer Co., Oakley, Cincinnati, O. See page 228
 Davenport Machine Tool Co., New Bedford, Mass.
 National-Acme Mfg. Co., Cleveland, O. See pages 226, 227
 New Britain Machine Co., New Britain, Conn.

SCREW PLATES
 American Tap & Die Co., Greenfield, Mass.
 Butterfield & Co., Inc., Derby Line, Vt.
 Card Mfg. Co., S. W., Mansfield, Mass.
 Conant & Donelson Co., Conway, Mass.
 *Greenfield Tap and Die Corp'n, Greenfield, Mass.

SCREW STEEL
 Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. See page 210

Cold Drawn

*Union Drawn Steel Co., Beaver Falls, Pa. See page 208

SCREW THREAD ROLLING MACHINES
 Blake & Johnson Co., Waterbury, Conn. See page 235

SCREWS

Cap and Set

Chicago Screw Co., 1020 S. Homan Ave., Chicago, Ill.
 Detroit Screw Works, Detroit, Mich.
 Ferry Cap & Set Screw Co., 2151 Scranton Road, Cleveland, O.
 Fostoria Screw Co., Fostoria, O.
 Niagara Screw Co., 20 Lock St., Buffalo, N. Y.
 Rhode Island Tool Co., Providence, R. I.
 Shimer & Sons, Samuel J., Milton, Pa.
 St. Louis Screw Co., St. Louis, Mo.
 U. S., Automatic Co., 524 Rockefeller Bldg., Cleveland, O.
 Western Automatic Machine Screw Co., Elyria, O.
 Worcester Machine Screw Co., Worcester, Mass.

Machine

American Screw Co., Providence, R. I. See pages 256, 257
 Blake & Johnson Co., Waterbury, Conn. See page 235
 Corbin Screw Corp'n, Division American Hardware Corp'n, New Britain, Conn.
 Detroit Screw Works, Detroit, Mich.
 Harvey Hubbell, Inc., State St. & Bostwick Ave., Bridgeport, Conn.
 Moore, George W., 44 Farnsworth St., Boston, Mass.
 Progressive Mfg. Co., Torrington, Conn.

Worcester Machine Screw Co., Worcester, Mass.

Safety Set

Allen Mfg. Co., Hartford, Conn.
 *Bristol Co., Waterbury, Conn. See page 327
 New Haven Screw Co., 191-193 Foster St., New Haven, Conn.
 Progressive Mfg. Co., Torrington, Conn.
 Standard Pressed Steel Co., Philadelphia, Pa.

Socket Head

Allen Mfg. Co., Hartford, Conn.

Wood

American Screw Co., Providence, R. I. See pages 256, 257
 Corbin Screw Corp'n, Division American Hardware Corp'n, New Britain, Conn.
 Reading Screw Co., Norristown, Pa.

SEALING MACHINES, CARTON
 Automatic Weighing Machine Co., 134-140 Commerce St., Newark, N. J.

SEPARATORS

Ammonia

*De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. See page 25

Magnetic

Buchanan Co., Inc., C. G., 90 West St., New York, N. Y.
 Dienelt & Eisenhardt Co., Inc., 1304 N. Howard St., Philadelphia, Pa.

Metal Chip

National Separator & Machine Co., 89 State St., Boston, Mass.
 Oil & Waste Saving Machine Co., 1509 Real Estate Trust Bldg., Philadelphia, Pa. See page 130

Oil

Albany Steam Trap Co., 317 N. Pearl St., Albany, N. Y.
 Anderson Co., V. D., W. 96th St., Cleveland, O.
 Andrews, Inc., William, 120 Liberty St., New York, N. Y. See page 84
 Beggs & Co., James, 36 Warren St., New York, N. Y.
 Cartwright-Caps Co., 1240 Transportation Bldg., Chicago, Ill.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 *De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. See page 25
 Direct Separator Co., Syracuse, N. Y.
 Gardner Governor Co., Quincy, Ill. See page 274
 Grisco-Russell Co., 90 West St., New York, N. Y.
 Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. See pages 76, 77
 Hershey Machine & Foundry Co., Manheim, Pa.
 Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. See page 110
 Liberty Mfg. Co., 6907 Susquehanna St., Pittsburgh, Pa.
 *National Pipe Bending Co., New Haven, Conn. See pages 78, 79
 Open Coil Heater & Purifier Co., Indianapolis, Ind.
 Standard Steam Specialty Co., 542-544 West Broadway, New York, N. Y.
 Webster & Co., Warren, Camden, N. J. See pages 80, 81, 82, 83

Oil (Centrifugal)

American Tool & Machine Co., 109 Beach St., Boston, Mass.
 National Separator & Machine Co., 89 State St., Boston, Mass.

Steam

American District Steam Co., North Tona-wanda, N. Y.

Sep

See Catalogue Section for data of firms listed in bold face type

SEPARATORS (continued)**Steam**

- Anderson Co., V. D., W. 96th St., Cleveland, O.
 Baragwanath & Son, Wm., 1260 W. Division St., Chicago, Ill.
 Colles Heater & Specialty Co., 14 East Jackson Blvd., Chicago, Ill.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 103*
 Direct Separator Co., Syracuse, N. Y.
 Gardner Governor Co., Quincy, Ill. *See page 274*
 Griscom-Russell Co., 90 West St., New York, N. Y.
 Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. *See pages 76, 77*
 Hershey Machine & Foundry Co., Manheim, Pa.
 Hoppes Mfg. Co., Springfield, O.
 Jacobs & Co., Charles, 258 Franklin St., Boston, Mass.
 Kleley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*
 *National Pipe Bending Co., New Haven, Conn. *See pages 78, 79*
 Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.
 Ohio Blower Co., Cleveland, O.
 Open Coil Heater & Purifier Co., Indianapolis, Ind.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Plant Engineering & Equipment Co., Inc., 6 Church St., New York, N. Y.
 Power Plant Specialty Co., 1306 Monadnock Bldg., Chicago, Ill.
 Provost Engineering Corp'n, Eatle & Provost Sts., Brooklyn, N. Y.
 Robertson & Sons, James L., 78-80 Murray St., New York, N. Y.
 Sims Co., Erie, Pa.
 Standard Steam Specialty Co., 542-544 West Broadway, New York, N. Y.
 Steam Appliance Co., West Allis, Wis.
 Steam Equipment Mfg. Co., 8077 Jenkins Arcade Bldg., Pittsburgh, Pa.
 Vance-Vetter Co., First National Bank Bldg., Pittsburgh, Pa.
 Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

SET COLLARS

(See Collars, Shaft)

SEWAGE DISPOSAL EQUIPMENT

Gillespie Mfg. Corp'n, 12th & Monmouth Sts., Jersey City, N. J.

SEWAGE EJECTORS

(See Ejectors, Sewage)

SEWING MACHINERY

Trump Bros. Machine Co., Beech & Anchorage Sts., Wilmington, Del.

SHAFT TURNING MACHINES (Motor)

Cleveland Automatic Machine Co., 2269 Ashland Road, Cleveland, O.

SHAFTING**Cold Drawn**

- Bliss & Laughlin, Inc., Harvey, Ill.
 Compressed Steel Shafting Co., 393 Dorchester Ave., Boston, Mass.
 *Cumberland Steel Co., Cumberland, Md.
 *Union Drawn Steel Co., Beaver Falls, Pa. *See page 208*

Flexible

- Chicago Flexible Shaft Co., 579 La Salle Ave., Chicago, Ill.
 Coates Cliffin Mfg. Co., Worcester, Mass.
 Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.
 Plank Flexible Shaft Machine Co., 710 Monroe Ave., N. W., Grand Rapids, Mich.
 Stow Flexible Shaft Co., Philadelphia, Pa.

- Stow Mfg. Co., 443 State St., Binghamton, N. Y.
 Webb Mfg. Co., Foot of Centre St., Newark, N. J.
 White Dental Mfg. Co., S. S., 1130 Chestnut St., Philadelphia, Pa.

Turned and Ground

- *Cumberland Steel Co., Cumberland, Md.
 Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. *See page 210*

Turned and Polished

- Bliss & Laughlin, Inc., Harvey, Ill.
 *Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*
 *Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*
 Central Steel & Wire Co., 119 N. Peoria St., Chicago, Ill.
 Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*
 Columbia Steel & Shafting Co., Pittsburgh, Pa.
 Compressed Steel Shafting Co., 393 Dorchester Ave., Boston, Mass.
 Dodge Sales & Engineering Co., Mishawaka, Ind. *See pages 74, 144, 145, 146, 147*
 Eagle Tool & Machine Co., 519-523 South Ave., N. S., Pittsburgh, Pa.
 *Falls Clutch & Machinery Co., Cuyahoga Falls, O. *See page 143*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Medart Patent Pulley Co., St. Louis, Mo.
 Pardee Works, C. Perth Amboy, N. J.
 Ryerson & Son, Joseph T., Chicago, Ill.
 Shackley & Son Co., W. T., 49 High St., Boston, Mass.
 Standard Gauge Steel Co., Beaver Falls, Pa.
 *Union Drawn Steel Co., Beaver Falls, Pa. *See page 208*
 Upton & Gilman Machine Co., 587 Middlesex St., Lowell, Mass.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*
 Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. *See page 210*
 *Wood's Sons Co., T. B., Chambersburg, Pa. *See pages 150, 151*

SHAKING GRATES

(See Grates, Shaking)

SHAPER ATTACHMENTS

Stockbridge Machine Co., Worcester, Mass.

SHAPERS, METAL

- Boynnton & Plummer, Inc., Chester Depot, Va.
 Cochrane-Bly Co., Rochester, N. Y.
 Davis Machine Tool Co., Inc., 305 St. Paul St., Rochester, N. Y.
 Gould & Eberhardt, Newark, N. J.
 Hendey Machine Co., Torrington, Conn.
 Morton Mfg. Co., Muskegon Heights, Mich.
 Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J.
 Queen City Machine Tool Co., 1405 Sycamore St., Cincinnati, O.
 Rhodes Mfg. Co., Hartford, Conn.
 Smith & Mills Co., Cincinnati, O.
 Springfield Machine Tool Co., Springfield, O.
 Steptoe Co., John, Cincinnati, O.
 Stockbridge Machine Co., Worcester, Mass.

Pillar

Smith & Mills Co., Cincinnati, O.

SHAPES**Iron**

Lockhart Iron & Steel Co., Pittsburgh, Pa.

Steel

- Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.
 Jones & Laughlin Steel Co., Pittsburgh, Pa.
 Ryerson & Son, Joseph T., Chicago, Ill.
 Standard Gauge Steel Co., Beaver Falls, Pa.

Advertisements of firms marked * ap pear in The Journal, A. S. M. E.

Steel (Cold Drawn)

- Lancaster Steel Products Co., Lancaster, Pa.
 *Union Drawn Steel Co., Beaver Falls, Pa.
See page 208
 Ward's Sons, Edgar T., 50 Farnsworth St.,
 Boston, Mass. *See page 209*
 Wheelock, Lovejoy & Co., 23 Cliff St., New
 York, N. Y. *See page 210*

Steel (Pressed)

- Cleveland City Forge & Iron Co., Cleveland,
 O.
 Glasgow Iron Co., Pottstown, Pa. *See page*
60
 Osgood Bradley Car Co., Worcester, Mass.

Structural

- McDermott Engineering Co., Whitehall &
 Jordan Sts., Allentown, Pa.

SHARPENING DEVICES

- Chicago Wheel & Mfg. Co., 1101-1103 W.
 Monroe St., Chicago, Ill.

SHEARS**Angle**

- Kidder Mfg. Co., J. F., Burlington, Vt.
 Long & Allstatter Co., Hamilton, O. *See page*
213
 Williams, White & Co., Moline, Ill. *See page*
215

Bar

- Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Long & Allstatter Co., Hamilton, O. *See page*
213
 Novelty Iron Works Co., Dyersville, Ia.
 Williams, White & Co., Moline, Ill. *See page*
215

Circle

- Smith, H. Collier, 807-815 Scotten Ave.,
 Detroit, Mich.

Gate

- Long & Allstatter Co., Hamilton, O. *See page*
213
 Williams, White & Co., Moline, Ill. *See page*
215

Hydraulic

- *Alliance Machine Co., Alliance, O. *See page*
188
 Williams, White & Co., Moline, Ill. *See page*
215
 *Wood & Co., R. D., Philadelphia, Pa. *See*
pages 294, 295

Metal (Hand Power)

- Armstrong-Blum Mfg. Co., 339 N. Francisco
 Ave., Chicago, Ill.
 Tucker, W. R. & C. F., Hartford, Conn.
 Viking Shear Co., East Lake Road, Erie, Pa.

Plate

- Long & Allstatter Co., Hamilton, O. *See page*
213
 Williams, White & Co., Moline, Ill. *See page*
215
 *Wood & Co., R. D., Philadelphia, Pa. *See*
pages 294, 295

Power

- Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Cleveland Punch & Shear Works Co., Cleve-
 land, O.
 Covington Machine Co., 14 Wall St., New
 York, N. Y.
 Excelsior Tool & Machine Co., 31st & Ridge
 Ave., East St. Louis, Ill.
 Long & Allstatter Co., Hamilton, O. *See page*
213
 Pels & Co., Henry, 90 West St., New York,
 N. Y.
 Williams, White & Co., Moline, Ill. *See page*
216

Rotary

- Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Niagara Machine & Tool Works, Buffalo,
 N. Y. *See page 214*
 Smith, H. Collier, 807-815 Scotten Ave.,
 Detroit, Mich.

Squaring

- Aetna Foundry & Machine Co., Warren, O.
 Niagara Machine & Tool Works, Buffalo,
 N. Y. *See page 214*

SHEAVES**Rope**

- Bass Foundry & Machine Co., Fort Wayne,
 Ind. *See page 39*
 *Brown Co., A. & F., 79 Barclay St., New
 York, N. Y. *See page 136*
 *Caldwell & Son Co., H. W., 17th St. &
 Western Ave., Chicago, Ill. *See page 174*
 *Clyde Iron Works, 29th Ave. West & Michigan
 St., Duluth, Minn. *See page 190*
 Dodge Sales & Engineering Co., Mishawaka,
 Ind. *See pages 74, 144, 145, 146, 147*
 *Falls Clutch & Machinery Co., Cuyahoga
 Falls, O. *See page 143*
 *Hill Clutch Co., Cleveland, O. *See page 148*
 Litchfield Foundry & Machine Co., Litch-
 field, Ill.
 Ottumwa Iron Works, Ottumwa, Ia.
 Pyott Co., 955 Carroll Ave., Chicago, Ill.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave.,
 Chicago, Ill. *See pages 180, 181, 182*
 *Wood's Sons Co., T. B., Chambersburg, Pa.
See pages 150, 151

V-Belt

- Pyott Co., 955 Carroll Ave., Chicago, Ill.

SHEET METAL WORK

- Bridgeport Metal Goods Mfg. Co., Cherry St.,
 Bridgeport, Conn.
 *Caldwell & Son Co., H. W., 17th St. &
 Western Ave., Chicago, Ill. *See page 174*
 Gem Mfg. Co., 1229-43 Goebel St., N. S.,
 Pittsburgh, Pa.
 Hendrick Mfg. Co., Dundaff St., Carbondale,
 Pa.
 National Scale Co., Chicopee Falls, Mass.
 Richmond Engineering Co., 12 S. 8th St.,
 Richmond, Va.
 Weller Mfg. Co., 1820-1856 N. Kostner Ave.,
 Chicago, Ill. *See pages 180, 181, 182*
 Willcox Engineering Co., Saginaw, Mich. *See*
page 317

SHEET METAL WORKING MACHINERY

- Bliss Co., E. W., 19 Adams St., Brooklyn,
 N. Y. *See page 212*
 Ferracute Machine Co., Bridgeton, N. J.
 Leffler & Co., Chas., 49-73 Clymer St.,
 Brooklyn, N. Y.
 Niagara Machine & Tool Works, Buffalo,
 N. Y. *See page 214*
 Pettingell Machine Co., Amesbury, Mass.
 Smith, H. Collier, 807-815 Scotten Ave.,
 Detroit, Mich.
 V & O Press Co., (Glendale) Brooklyn,
 N. Y.
 Waterbury Farrel Foundry & Machine Co.,
 Waterbury, Conn.
 Yoder Co., 1024 B. of L. E. Bldg., Cleveland,
 O.

SHELL-TRIMMING MACHINES

- Espen-Lucas Machine Works, Front St. &
 Girard Ave., Philadelphia, Pa.

SHELLS, LAP WELDED**Boiler**

- American Welding Co., Carbondale, Pa.

Ice Machine

- American Welding Co., Carbondale, Pa.

SHELVING, METAL

- Durand Steel Locker Co., 76 W. Monroe St.,
 Chicago, Ill.

See Catalogue Section for data of firms listed in bold face type

SHELVING, METAL (continued)

Lyon Metallic Mfg. Co., Aurora, Ill.
Terrell's Equipment Co., Grand Rapids, Mich.

SHIP CABLES

Standard Chain Co., Pittsburgh, Pa.

SHOP FURNITURE

Lucas & Sons, J. L., 3 Fox St., Bridgeport, Conn.
New Britain Machine Co., New Britain, Conn.

SHOVELS, STEAM

Bucyrus Co., South Milwaukee, Wis.
Keystone Driller Co., Beaver Falls, Pa.
Marion Steam Shovel Co., Station D, Marion, O.
Osgood Co., Marion, O.

SHREDDERS, CHIP

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.
Williams Patent Crusher & Pulverizer Co., Old Colony Bldg., Chicago, Ill. *See pages 302, 303*

SHUTTERS, ROLLING

Edwards Mfg. Co., 306-336 Eggleston Ave., Cincinnati, O. *See page 269*

SIFTING MACHINERY

Holmes & Blanchard Co., 31 State St., Boston, Mass.

SIGHT-FEEDS

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 125*

*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*

SILENCERS, GAS ENGINE

Maxim Silencer Co., Hartford, Conn.

SILICON METAL

Carborundum Co., Niagara Falls, N. Y. *See page 248*

SILK MACHINERY

Saco-Lowell Shops, 77 Franklin St., Boston, Mass.

SIPHONS, STEAM

American Injector Co., Detroit, Mich. *See page 116*

Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

Ohio Injector Co., S. Main St., Wadsworth, O.

Penberthy Injector Co., Detroit, Mich. *See page 117*

SIRENS

(See Whistles, Steam)

SKIMMERS, BOILER

Buckeye Boiler Skimmer Co., 519-523 Colburn St., Toledo, O.

SKIPS

Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

SKYLIGHT GEARING

Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

SKYLIGHTS, STEEL

Asbestos Protected Metal Co., 1st Natl. Bank Bldg., Pittsburgh, Pa.

Drouve Co., G., 40 Drouve St., Bridgeport, Conn.

Edwards Mfg. Co., 306-336 Eggleston Ave., Cincinnati, O. *See page 269*

Lupton's Sons Co., David, Tulip St. & Allegheny Ave., Philadelphia, Pa.

Van Noorden & Co., E., 100 Magazine St., Boston, Mass.

SLINGS**Chain**

Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*

Weimer Chain & Iron Co., Lebanon, Pa.
Woodhouse Chain Works, Trenton, N. J.

Wire Rope

*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*

SLITTING MACHINES**Metal**

Blake & Johnson Co., Waterbury, Conn. *See page 235*

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Paper

Knowlton Co., M. D., Rochester, N. Y.

SLOTTERS, MACHINE

Betts Machine Co., Wilmington, Del.

Dill Machine Co., Inc., T. C., Philadelphia, Pa. *See page 229*

Newton Machine Tool Works, Inc., 23rd & Vine Sts., Philadelphia, Pa.

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

SLUICE GATES

(See Gates, Sluice)

SMELTING MACHINERY

Worthington Pump & Mch. Corp'n (Power & Mining Mch. Works), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

SMOKE STACKS AND FLUES

(See Stacks, Steel)

SMOKELESS FURNACES

(See Furnaces, Smokeless)

SOCKETS, WIRE ROPE

(See Wire Rope Fastenings)

SOLDER

Empire Metal Co., Syracuse, N. Y.

Riverside Metal Refining Co., Connellsville, Pa.

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

SOLENOIDS AND MAGNETS

Acme Wire Co., New Haven, Conn.

SOLUTIONS, METAL HARDENING

Metal Hardening Solution Co., Rochester, N. Y.

SOLVENT RECOVERY APPARATUS

Carrier Engineering Corp'n, 39 Cortlandt St., New York, N. Y.

SOOT BLOWING SYSTEMS

Bayer Steam Soot Blower Co., 2828-2840 La Salle St., St. Louis, Mo.

*Diamond Power Specialty Co., Detroit, Mich. *See page 73*

Monarch Steam Blower Co., Troy, N. Y.

SPACING TABLES (Structural Shop)

Standard Bridge Tool Co., 1226 Fulton Bldg., Pittsburgh, Pa.

SPARK PLUGS

(See Plugs, Spark)

SPECIAL MACHINERY

American Machine & Foundry Co., 2250 Second Ave., Brooklyn, N. Y.

Atlantic Works, 80 Border St., East Boston, Mass.

Babson-Dow Mfg. Co., 60 Fulda St., Roxbury Station, Boston, Mass.

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

Blount Engineering Co., 100 High St., Boston, Mass.

Boeger-Meyer Machine & Tool Co., 59-65 McWhorter St., Newark, N. J.

Braddock Machine & Mfg. Co., Braddock, Pa.

*Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*

Burroughs Co., Charles, 141-149 Commerce St., Newark, N. J.

Cameron Engineering Co., East Stroudsburg, Pa.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Carroll Foundry & Machine Co., Bucyrus, O.
Clark Bros. Co., Olean, N. Y.
Columbus Die, Tool & Machine Co., Columbus, O.

*Cordrey Machine Works, C. H., Fitchburg, Mass. *See page 236*

Currier & Sons, Cyrus, Newark, N. J.

*Defiance Machine Works, Defiance, O.

Dice Machine Co., Anderson, Ind.

Fay & Scott, Dexter, Me.

Footo Bros. Gear & Machine Co., 210-220 N.

Carpenter St., Chicago, Ill.

Gisholt Machine Co., Madison, Wis.

Grant Mfg. & Machine Co., Bridgeport, Conn.

Griswold Machine Co., George M., Cor.

Bradley & William Sts., New Haven, Conn.

Hardie-Tynes Mfg. Co., Birmingham, Ala.

See page 14

*Harris-Corliss Engine & Machine Co., Providence, R. I. *See page 15*

Harris Engineering Co., H. E., 1041-1055

Broad St., Bridgeport, Conn. *See page 237*

Hartford Special Machinery Co., Hartford, Conn.

Heartley Machine, Variety Iron & Tool Works,

900-908 Summit St. Cor. Locust, Toledo, O.

*Hill Clutch Co., Cleveland, O. *See page 148*

Holland Machine Co., 90 W. Broadway,

New York, N. Y.

Horton Machine Works, Elmira, N. Y.

Hubbard's Sons, Norman, 265 Water St.,

Brooklyn, N. Y.

Johnston & Jennings Co., Cleveland, O.

Koven & Brother, L. O., Jersey City, N. J.

See page 301

Lake Erie Engineering Works, Buffalo, N. Y.

*Lammert & Mann Co., Wood & Walnut

Sts., Chicago, Ill. *See page 293*

Marshall Foundry Co., 28th & Railroad Sts.,

Pittsburgh, Pa. *See page 306*

Marvin & Casler Co., Canastota, N. Y.

Massey Machine Co., Watertown, N. Y.

Mehl Machine, Tool & Die Co., Roselle,

N. J. *See pages 238, 239*

Meriden Press & Drop Co., 153 State St.,

Meriden, Conn.

Minneapolis Steel & Machinery Co., Minne-

apolis, Minn.

*Morris Co., I. P., Philadelphia, Pa. *See page*

296

Nestor Mfg. Co., 40 W. 13th St., New York,

N. Y.

Nilson Machine Co., A. H., 1525 Railroad Ave.

Bridgeport, Conn.

Nilson-Miller Co., 1300 Hudson St., Hoboken,

N. J.

Oswego Machine Works, Oswego, N. Y.

Pawtucket Mfg. Co., Pawtucket, R. I.

Phoenix Iron Works Co., Meadville, Pa. *See*

page 53

Poole Engineering & Machine Co., Baltimore,

Md.

Pratt Engineering & Machine Co., Atlanta,

Ga.

Redington Co., F. B., 112-114 So. Sangamon

St., Chicago, Ill.

Reeves-Cubberley Engine Co., Trenton, N. J.

Remmers & Sons, B., 1227 Germantown Ave.,

Philadelphia, Pa.

Riehle Bros. Testing Machine Co., 1424 N.

9th St., Philadelphia, Pa. *See page 313*

Sheffield Machine & Tool Co., Dayton, O.

Shepherd Engineering Co., Williamsport, Pa.

Sigourney Tool Co., 9 Sigourney St., Hart-

ford, Conn.

Sloan & Chase Mfg. Co., Ltd., 6th Ave., Cor.

N. 13th St., Newark, N. J. *See page 233*

Slocum, Avram & Slocum Laboratories, Inc.,

New York, N. Y. *See page 337*

Stacey-Schmidt Mfg. Co., York, Pa.

Stow Flexible Shaft Co., Philadelphia, Pa.

Taft-Pierce Mfg. Co., Woonsocket, R. I.

Tod Co., William S., Phelps St., Youngs-

town, O.

Torrington Mfg. Co., Torrington, Conn. *See*

page 210

*Vilter Mfg. Co., 1194-1196 Clinton St., Mil-

wauke, Wis. *See page 277*

Waltham Machine Works, 296 Newton St.,

Waltham, Mass.

Washburn & Granger, 50 Church St., New

York, N. Y. *See page 72*

Webster & Parks Tool Co., Springfield, O.

Weiss, Louis T., 286 Taaffe Place, Brooklyn,

N. Y.

Wetherill & Co., Inc., Robt., Chester, Pa.

See page 19

Williams, White & Co., Moline, Ill. *See*

page 215

Wilson Machine Co., W. A., 217 N. Water St.,

Rochester, N. Y.

*Wood & Co., R. D., Philadelphia, Pa. *See*

pages 294, 295

Yoder Co., 1024 B. of L. E. Bldg., Cleveland,

O.

York Electric & Machine Co., 30-34 N.

Penn St., York, Pa.

SPEED REDUCING GEARS

(See Gears, Speed Reduction)

SPEED TRANSMISSIONS, VARIABLE

*Moore & White Co., Philadelphia, Pa. *See*

page 149

Reeves Pulley Co., Columbus, Ind.

SPEEDOMETERS

Standard Thermometer Co., 65 Shirley St.,

Boston, Mass.

*Veeder Mfg. Co., Hartford, Conn. *See page*

341

Waltham Watch Co., Waltham, Mass.

SPIRAL CONVEYORS

(See Conveyors, Screw)

SPOOLS, METAL

American Pulley Co., 4200 Wissahickon Ave.,

Philadelphia, Pa. *See page 142*

SPOUTS, GRAIN

*Caldwell & Son Co., H. W., 17th St. & Western

Ave., Chicago, Ill. *See page 174*

Weller Mfg. Co., 1820-1856 N. Kostner Ave.,

Chicago, Ill. *See pages 180, 181, 182*

SPRAY COOLING SYSTEMS

*Spray Engineering Co., 93 Federal St., Boston,

Mass. *See page 87*

SPRAY NOZZLES

(See Nozzles, Spray)

SPRAYING MACHINERY

Star Brass Works, 319-31 N. Albany Ave.,

Chicago, Ill.

Metal

Metals Coating Co. of America, 122 S. Michigan

Ave., Chicago, Ill.

SPRAYS

Chemical and Industrial Purposes

Anthony Co., 138 West Ave., Long Island

City, N. Y. *See page 264*

Oil

Anthony Co., 138 West Ave., Long Island

City, N. Y. *See page 264*

Water

*Spray Engineering Co., 93 Federal St., Bos-

ton, Mass. *See page 87*

SPRING BALANCES

(See Balances, Spring)

SPRING MACHINES

Baird Machine Co., Bridgeport, Conn.

SPRING TESTING MACHINES

Olsen Testing Machine Co., Tinius, 500 N.

12th St., Philadelphia, Pa. *See page 312*

Riehle Bros. Testing Machine Co., 1424 N.

9th St., Philadelphia, Pa. *See page 313*

SPRINGS

Car and Locomotive

Pittsburgh Spring & Steel Co., Farmers

Bank Bldg., Pittsburgh, Pa.

Union Spring & Mfg. Co., 2408 First Nat'l

Bank, Pittsburgh, Pa.

See Catalogue Section for data of firms listed in bold face type

SPRINGS (continued)**Colled**

Cleveland Wire Spring Co., Cleveland, O.
Cook & Spring Co., 420 East 106th St.,
New York, N. Y.
New York Wire & Spring Co., 586 Washing-
ton St., New York, N. Y.

Machinery

Pittsburgh Spring & Steel Co., Farmers
Bank Bldg., Pittsburgh, Pa.
Raymond Mfg. Co., Ltd., Corry, Pa.

Rubber

Boston Belting Co., 84 Linden Park St.,
Boston, Mass. *See page 162*

Vanadium

Raymond Mfg. Co., Ltd., Corry, Pa.

Vehicle (Flat Leaf)

Liggett Spring & Axle Co., Monongahela, Pa.
Perfection Spring Co., 6524 Central Ave.,
Cleveland, O.

Wire

New York Wire & Spring Co., 586 Washington
St., New York, N. Y.
Raymond Mfg. Co., Ltd., Corry, Pa.

SPRINKLER SYSTEMS, FIRE (Automatic)

Automatic Sprinkler Co. of America, 123
William St., New York, N. Y.
General Fire Extinguisher Co., 275 West
Exchange St., Providence, R. I.
Globe Automatic Sprinkler Co., 2035 Washing-
ton Ave., Philadelphia, Pa.
Rockwood Sprinkler Company of Mass.,
34-56 Harlow St., Worcester, Mass.

SPRINKLERS**Automatic**

Globe Automatic Sprinkler Co., 2035 Wash-
ington Ave., Philadelphia, Pa.

Spray

Spr *Spray Engineering Co., 93 Federal St., Boston,
Mass. *See page 87*

SPROCKETS

American Highspeed Chain Co., 401 S. Illi-
nois St., Indianapolis, Ind.
Baldwin Chain & Mfg. Co., 199 Chandler St.,
Worcester, Mass.
*Caldwell & Son Co., H. W., 17th St. & Western
Ave., Chicago, Ill. *See page 174*
*Chain Belt Co., 734 Park St., Milwaukee, Wis.
See pages 176, 177
Diamond Chain & Mfg. Co., 241 W. Georgia
St., Indianapolis, Ind.
Grant Gear Works, 151 Pearl St., Boston,
Mass.
*Hill Clutch Co., Cleveland, O. *See page 148*
Lehigh Car, Wheel & Axle Works, Catasauqua,
Pa. *See page 69*
*Link-Belt Co., Chicago, Ill. *See page 178*
Mey Chain Belt Co., 82 Washington St.,
Buffalo, N. Y.
Schultz & Son, A. L., 1675 Elston Ave.,
Chicago, Ill.
Turley Gear & Machine Co., 1505 N. 10th
St., St. Louis, Mo.
Union Iron Works, Decatur, Ill.
Weller Mfg. Co., 1820-1856 N. Kostner Ave.,
Chicago, Ill. *See pages 180, 181, 182*

STACKS, STEEL

Bass Foundry & Machine Co., Fort Wayne,
Ind. *See page 39*
*Bigelow Co., 76 River St., New Haven, Conn.
See page 40
Birmingham Boiler Works, Birmingham, Ala.
Casey-Hedges Co., Chattanooga, Tenn. *See*
pages 42, 43
Codd Co., E. J., 700-708 S. Caroline St.,
Baltimore, Md.
Dover Boiler Works, 50 Church St., New York,
N. Y.
Frost Mfg. Co., Galesburg, Ill.

Houston, Stanwood & Gamble Co., Cincinnati,
O. *See pages 46, 47*

*Keeler Co., E., Williamsport, Pa. *See page 45*
Kittos Boiler & Tank Co., Canton, O.
Koven & Brother, L. O., Jersey City, N. J.
See page 301

McDermott Engineering Co., Whitehall &
Jordan Sts., Allentown, Pa.
McNaull Boiler Mfg. Co., Toledo, O.
McNeil & Bro. Co., James, Pittsburgh, Pa.
Michelmann Steel Construction Co., Quincy,
Ill.

Milwaukee Boiler Co., 220 Oregon St., Mil-
waukee, Wis. *See page 50*

Mohr & Sons, John, 349-359 W. Illinois St.,
Chicago, Ill. *See page 51*

Munroe & Sons, R., 23rd & Smallman Sts.,
Pittsburgh, Pa.

Murray Iron Works Co., Burlington, Ia. *See*
page 16

Muskegon Boiler Works, Muskegon, Mich.
New York Central Iron Works Co., Inc.,
Hagerstown, Md.

Pickham Boiler Co., 3035 W. Jackson Blvd.,
Chicago, Ill.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau
Ave., St. Louis, Mo.

Shofield's Sons Co., J. S., Macon, Ga.

Turl Iron & Car Co., Inc., 50 Broad St.,
New York, N. Y.

Union Boiler & Mfg. Co., Lebanon, Pa.
Vogt Machine Co., Henry, Louisville, Ky. *See*
page 55

Wetherill & Co., Inc., Robt., Chester, Pa.
See page 19

Wilson Steam Boiler Co., 1919-27 S. 20th St.,
Omaha, Neb.

STAMP MILL WEARING PARTS

Chrome Steel Works, Chrome, N. J.

STAMPINGS, SHEET METAL

Bridgeport Metal Goods Mfg. Co., Cherry
St., Bridgeport, Conn.

Gem Mfg. Co., 1229-43 Goebel St., N. S.,
Pittsburgh, Pa.

Globe Machine & Stamping Co., Cleveland, O.
McKinney Mfg. Co., Pittsburgh, Pa.

Matthews Mfg. Co., Worcester, Mass.
Miller Lock Co., Philadelphia, Pa.

Mossberg Co., Frank, Attleboro, Mass.
Nelson Mfg. Co., A., 564-572 W. Randolph
St., Chicago, Ill.

Robinson Tool Works, Inc., Waterbury, Conn.
Rockwood Sprinkler Company of Mass.,
34-56 Harlow St., Worcester, Mass.

Root Co., C. J., 150 Bridge St., Bristol, Conn.
See page 340

Schatz Mfg. Co., Poughkeepsie, N. Y.

Willcox Engineering Co., Saginaw, Mich. *See*
page 317

Worcester Pressed Steel Co., Worcester,
Mass.

Zenite Metal Co., Indianapolis, Ind.

STAMPS AND DIES, STEEL

Bliss Co., E. W., 19 Adams St., Brooklyn,
N. Y. *See page 212*

Hogson & Pettis Mfg. Co., New Haven, Conn.
See pages 250, 251, 252

Noble & Westbrook Mfg. Co., Hartford,
Conn. *See page 241*

Owen & Co., E. H., 101-109 N. Jefferson St.,
Chicago, Ill.

STANDPIPES

Bass Foundry & Machine Co., Fort Wayne,
Ind. *See page 39*

Shofield's Sons Co., J. S., Macon, Ga.

Concrete

Heine Chimney Co., 123 W. Madison St.,
Chicago, Ill.

STARCH MACHINERY

Remmers & Sons, B., 1227 Germantown Ave.,
Philadelphia, Pa.

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

STEAM ENGINES, SEPARATORS, SHOVELS, TRAPS, ETC. (See Engines, Separators, Shovels, Traps, etc., Steam)

STEAM SPECIALTIES

- American Blower Co.**, Detroit, Mich. See pages 280, 281
American District Steam Co., North Tonawanda, N. Y. See page 118
American Injector Co., Detroit, Mich. See page 116
American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322
Automatic Steam Trap Specialty Co., 2707 Vestry Ave., Cleveland, O.
***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324
***Davis Regulator Co.**, G. M., 422 Milwaukee Ave., Chicago, Ill.
D'Este Co., Julian, 26 Canal St., Boston, Mass. See page 108
Foster Engineering Co., Newark, N. J. See page 109
Industrial Supply & Equipment Co., 407 Sansom St., Philadelphia, Pa.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. See page 110
Klipfel Mfg. Co., 2651-59 W. Harrison St., Chicago, Ill.
Loneragan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325
Mechanical Scale Prevention Co., 150 Nassau St., New York, N. Y.
Open Coil Heater & Purifier Co., Indianapolis, Ind.
Penberthy Injector Co., Detroit, Mich. See page 117
***Pittsburgh Valve, Foundry & Construction Co.**, Pittsburgh, Pa. See pages 102, 103
Powell Co., Wm., 2521-31 Spring Grove Ave., Cincinnati, O.
Ross Valve Mfg Co., Troy, N. Y.
Simplex Tester Co., Harvard Square, Cambridge, Mass.
Taylor Steam Specialty Co., Battle Creek, Mich. See page 114
Watson & McDaniel Co., 146 N. Seventh St., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J. See pages 80, 81, 82, 83

STEEL

Alloy

- Atlas Crucible Steel Co.**, Dunkirk, N. Y.
Carbon Steel Co., P. O. Box 1591, Pittsburgh, Pa.
Colonial Steel Co., Pittsburgh, Pa.
Columbia Tool Steel Co., Chicago Heights, Ill.
Davidson Steel Co., Inc., 124 Maiden Lane, New York, N. Y. See page 206
Halcomb Steel Co., Syracuse, N. Y.
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. See page 207
Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.
Ludlum Steel Co., 2 Rector St., New York, N. Y.
United Steel Co., Canton, O.
Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. See page 210
York Mfg. Co., York, Pa.

Alloy (Cold Drawn)

- *Union Drawn Steel Co.**, Beaver Falls, Pa. See page 208

Bright Finished

- Columbia Steel & Shafting Co.**, Pittsburgh, Pa.
***Union Drawn Steel Co.**, Beaver Falls, Pa. See page 208

Chrome Nickel

- Davidson Steel Co., Inc.**, 124 Maiden Lane, New York, N. Y. See page 206

Chrome Vanadium

- Davidson Steel Co., Inc.**, 124 Maiden Lane, New York, N. Y. See page 206
United Steel Co., Canton, O.

Cold Drawn

- Bliss & Laughlin, Inc.**, Harvey, Ill.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. See page 207
Lancaster Steel Products Co., Lancaster, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
***Union Drawn Steel Co.**, Beaver Falls, Pa. See page 208

Cold Rolled

- American Tube & Stamping Co.**, 471 Hancock Ave., Bridgeport, Conn.
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. See page 207
***Union Drawn Steel Co.**, Beaver Falls, Pa. See page 208
Ward's Sons, Edgar T., 50 Farnsworth St., Boston, Mass. See page 209
Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. See page 210

Crucible

- Atlas Crucible Steel Co.**, Dunkirk, N. Y.
Braeburn Steel Co., Braeburn, Pa.
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. See page 207
Ludlum Steel Co., 2 Rector St., New York, N. Y.

Crucible (Cold Drawn)

- *Union Drawn Steel Co.**, Beaver Falls, Pa. See page 208

Electric Furnace

- Braeburn Steel Co.**, Braeburn, Pa.
Halcomb Steel Co., Syracuse, N. Y.
Hess Steel Corp'n, Baltimore, Md.
Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.

High Speed

- Allen & Co., Ltd.**, Edgar, 718-22 W. Lake St., Chicago, Ill.
Andrew & Co., Ltd., Jno. Hy., 26 Cortlandt St., New York, N. Y.
Atlas Crucible Steel Co., Dunkirk, N. Y.
Colonial Steel Co., Pittsburgh, Pa.
Columbia Tool Steel Co., Chicago Heights, Ill.
Cyclops Steel Co., 115 Broadway, New York, N. Y.
Davidson Steel Co., Inc., 124 Maiden Lane, New York, N. Y. See page 206
Firth-Sterling Steel Co., McKeesport, Pa.
Halcomb Steel Co., Syracuse, N. Y.
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. See page 207
Hobson, Houghton & Co., Ltd., 83 Beekman St., New York, N. Y.
Jones & Co., Inc., B. M., 141 Milk St., Boston, Mass.
McInnes Steel Co., Ltd., Corry, Pa.
Metro Steel Co., Wabash Bldg., Pittsburgh, Pa.
Ward's Sons, Edgar T., 50 Farnsworth St., Boston, Mass. See page 209
Wheelock, Lovejoy & Co., 23 Cliff St., New York, N. Y. See page 210

Magnet

- Atlas Crucible Steel Co.**, Dunkirk, N. Y.

Manganese

- American Manganese Steel Co.**, 1850 McCormick Bldg., Chicago, Ill.

Nickel

- Andrew & Co., Ltd.**, Jno. Hy., 26 Cortlandt St., New York, N. Y.
Davidson Steel Co., Inc., 124 Maiden Lane, New York, N. Y. See page 206
Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. See page 207

See Catalogue Section for data of firms listed in bold face type

STEEL (continued)**Nickel**

*Union Drawn Steel Co., Beaver Falls, Pa.
See page 208

Open Hearth

Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lukens Iron & Steel Co., Coatesville, Pa. See
page 61

United Steel Co., Canton, O.

Open Hearth (Cold Drawn)

*Union Drawn Steel Co., Beaver Falls, Pa.
See page 208

Sheet

Allegheny Steel Co., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., 23 Cliff St., New
York, N. Y. See page 210

Shim

Central Steel & Wire Co., 119 N. Peoria St.,
Chicago, Ill.

Spring

Davidson Steel Co., Inc., 124 Maiden Lane,
New York, N. Y. See page 206
Halcomb Steel Co., Syracuse, N. Y.
Haring, Ellsworth, 114-118 Liberty St., New
York, N. Y. See page 207

Strip

Central Steel & Wire Co., 119 N. Peoria St.,
Chicago, Ill.

Haring, Ellsworth, 114-118 Liberty St.,
New York, N. Y. See page 207

Lancaster Steel Products Co., Lancaster, Pa.
Ward's Sons, Edgar T., 50 Farnsworth St.,
Boston, Mass. See page 209

Wheelock, Lovejoy & Co., 23 Cliff St., New
York, N. Y. See page 210

Strip (Tempered and Blued)

Ward's Sons, Edgar T., 50 Farnsworth St.,
Boston, Mass. See page 209

Tool

Allen & Co., Ltd., Edgar, 718-22 W. Lake St.,
Chicago, Ill.

Andrews & Co., Ltd., Jno. Hy., 26 Cortlandt
St., New York, N. Y.

Atlas Crucible Steel Co., Dunkirk, N. Y.

Carpenter Steel Co., Reading, Pa.

Colonial Steel Co., Pittsburgh, Pa.

Columbia Tool Steel Co., Chicago Heights, Ill.
Cyclops Steel Co., 115 Broadway, New York,
N. Y.

Davidson Steel Co., Inc., 124 Maiden Lane,
New York, N. Y. See page 207

Firth-Sterling Steel Co., McKeesport, Pa.

Halcomb Steel Co., Syracuse, N. Y.

Haring, Ellsworth, 114-118 Liberty St.,
New York, N. Y. See page 207

Hobson, Houghton & Co., Ltd., 83 Beekman
St., New York, N. Y.

Jones & Co., Inc., B. M., 141 Milk St., Boston,
Mass.

McInnes Steel Co., Ltd., Corry, Pa.

Metro Steel Co., Wahash Bldg., Pittsburgh, Pa.
Pittsburgh Tool Steel Wire Co., Monaca,
Pa.

Swedish Iron & Steel Corp'n, 12 Platt St.,
New York, N. Y.

Ward's Sons, Edgar T., 50 Farnsworth St.,
Boston, Mass. See page 209

Wheelock, Lovejoy & Co., 23 Cliff St., New
York, N. Y. See page 210

Vanadium

*Union Drawn Steel Co., Beaver Falls, Pa.
See page 208

STEEL BARS

Carbon Steel Co., P. O. Box 1591, Pittsburgh,
Pa.

Pardee Works, C., Perth Amboy, N. J.

STEEL BILLETS

Hess Steel Corp'n, Baltimore, Md.

Lukens Iron & Steel Co., Coatesville, Pa. See
page 61

Pardee Works, C., Perth Amboy, N. J.
Whitaker Glessner Co., Portsmouth, O.
Wood Iron & Steel Co., Alan, Widener Bldg.,
Philadelphia, Pa.

STEEL BLOOMS

Lukens Iron & Steel Co., Coatesville, Pa. See
page 61

Wood Iron & Steel Co., Alan, Widener Bldg.,
Philadelphia, Pa.

STEEL DISCS

Lukens Iron & Steel Co., Coatesville, Pa. See
page 61

STEEL PLATE CONSTRUCTION

Bass Foundry & Machine Co., Fort Wayne,
Ind. See page 39

*Bigelow Co., 76 River St., New Haven, Conn.
See page 40

Brennan & Co., John, Detroit, Mich.
Burham Co., Edwin, 71 Wall St., New York,
N. Y.

Casey-Hedges Co., Chattanooga, Tenn. See
pages 42, 43

Cave Welding & Mfg. Co., 32 Liberty St.,
Springfield, Mass.

Coatesville Boiler Works, Coatesville, Pa.

Farrar & Trefts, 54-66 Perry St., Buffalo,
N. Y.

Gillespie Mfg. Corp'n, 12th & Monmouth
Sts., Jersey City, N. J.

*Graver Tank Works, Wm., East Chicago,
Ind.

Hammond Iron Works, Warren, Pa.

*Heine Safety Boiler Co., St. Louis, Mo.

Houston, Stanwood & Gamble Co., Cincinnati,
O. See pages 46, 47

*Keeler Co., E., Williamsport, Pa. See page 45

Kittow Boiler & Tank Co., Canton, O.

Koven & Brother, L. O., Jersey City, N. J.
See page 301

McAleenan Bros. Co., Pittsburgh, Pa.

Mackinnon Boiler & Machine Co., 218-230
N. Water St., Bay City, Mich.

McNeil & Bro. Co., James, Pittsburgh, Pa.
Mecklenburg Iron Works, Charlotte, N. C.

Milwaukee Boiler Co., 220 Oregon St., Mil-
waukee, Wis. See page 50

Mohr & Sons, John, 349-359 W. Illinois St.,
Chicago, Ill. See page 51

Munroe & Sons, R., 23rd & Smallman Sts.,
Pittsburgh, Pa.

Murray Iron Works Co., Burlington, Ia. See
page 16

Petroleum Iron Works Co., Sharon, Pa.

Pickham Boiler Co., 3035 W. Jackson Blvd.,
Chicago, Ill.

Riter-Conley Mfg. Co., Pittsburgh, Pa.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau
Ave., St. Louis, Mo.

Smith & Son Co., Sam'l, Paterson, N. J.

Specialty Engineering Co., Allegheny & Tren-
ton Aves., Philadelphia, Pa.

Standard Boiler & Plate Iron, Nilis, O.

Struthers Wells Co., Warren, Pa.

Treadwell Construction Co., Midland, Pa.

Turl Iron & Car Co., Inc., 50 Broad St.,
New York, N. Y.

Union Boiler & Mfg. Co., Lebanon, Pa.

Walsh's Holyoke Steam Boiler Works, Holyoke,
Mass.

Wetherill & Co., Inc., Robt., Chester, Pa. See
page 19

Whitehead & Kales Iron Works, Beecher Ave.
& M. C. R. R., Detroit, Mich.

Wilson Steam Boiler Co., 1919-27 S. 20th St.,
Omaha, Neb.

*Wood & Co., R. D., Philadelphia, Pa. See
pages 294, 295

STEEL SHEETS

La Belle Iron Works, Steubenville, O.

Whitaker Glessner Co., Portsmouth, O.

Youngstown Sheet & Tube Co., Youngstown,
O.

STEEL SLABS

Whitaker Glessner Co., Portsmouth, O.

Ste

Wood Iron & Steel Co., Alan, Widener Bldg., Philadelphia, Pa.

STEEL TESTING APPARATUS

Elmer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

STEEL WORKS EQUIPMENT

*Mackintosh, Hemphill & Co., 12th & Etna Sts., Pittsburgh, Pa.
United Engineering & Foundry Co., Farmers' Bank Bldg., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, O.
Youngstown Engineering Co., Youngstown, O.

STEEPLE TOWERS (Coal)

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
Maine Electric Co., 35 Commercial St., Portland, Me.

STERILIZERS

Electric Water Sterilizer Co., Scottsdale, Pa.
Koven & Brother, L. O., Jersey City, N. J. *See page 301*
Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*

STILLS

Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*
Hodges Water Still Co., Pennsylvania Bldg., Philadelphia, Pa.
Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*
Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. *See page 50*
Sargent Steam Meter Co., 1902 W. California Ave., Chicago, Ill.
Standard Water Systems Co., Hampton, N. J.

Tar

Gas Machinery Co., 1900 Euclid Ave., Cleveland, O.

Welded

American Welding Co., Carbondale, Pa.

STOCKS AND DIES

Borden Co., Warren, O.
*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
Nye Tool & Machine Works, 108-128 N. Jefferson St., Chicago, Ill.
Reed Mfg. Co., Erie, Pa.
Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
Threading Machine Co., Sandusky, O.

STOKERS**Chain Grate**

*Babcock & Wilcox Co., 85 Liberty St., New York, N. Y. *See pages 34, 35, 36, 37*
Birch, Riley & Co., 41 Cortlandt St., New York, N. Y.
Crowe, Paul L., 33 Bidwell Ave., Jersey City, N. J.
*Green Engineering Co., East Chicago, Ind. *See pages 64, 65*
Illinois Stoker Co., Alton, Ill.
Keystone Stoker Co., Greenfield, Mass.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Rosdale Foundry & Machine Co., Pittsburgh, Pa.
Swift Stoker Co., Railway Exchange, Chicago, Ill.
*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Locomotive

Locomotive Stoker Co., North Side, Pittsburgh, Pa.

Overfeed

American Foundry & Casting Co., Dayton, O.
Burke Furnace Co., 223 W. Austin Ave., Chicago, Ill.
Detroit Stoker Co., Detroit, Mich. *See page 62*
McClave-Brooks Co., Scranton, Pa.

McKenzie Furnace Co., 647 McCormick Bldg., Chicago, Ill.

*Murphy Iron Works, Detroit, Mich. *See pages 66, 67*

Vasil Steam Systems Co., Hudson, Mass. *See page 63*

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

*Wetzel Mechanical Stoker Co. of New York, Inc., 30 Church St., New York, N. Y.

Overfeed (Anthracite)

Roach & Co., Inc., Joseph H., Bridgeport, Pa.

Powdered Coal

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa. *See page 39*

*Locomotive Pulverized Fuel Co., 30 Church St., New York, N. Y.

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Annealing Furnace)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Boiler Furnace)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Heating Furnace)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Locomotive)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Metallurgical Furnace)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Reverberatory Furnace)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Powdered Coal (Smokeless Furnace)

Stroud & Co., E. H., 928-934 Fullerton Ave., Chicago, Ill.

Traveling Grate (Anthracite)

Coxe Traveling Grate Co., 908 Markle Bank Bldg., Hazleton, Pa.

Underfeed

*American Engineering Co., Philadelphia, Pa.
*Combustion Engineering Corp'n, 11 Broadway, New York, N. Y.

Kokomo Foundry & Machine Co., Kokomo, Ind.

Lehigh Stoker Co., Fullerton, Pa.

Moloch Stoker Co., 774 Continental & Commercial Bank Bldg., Chicago, Ill.

Nelson Blower & Furnace Co., 11 Elkins St., Boston, Mass.

*Riley Stoker Co., Ltd., Sanford, Worcester, Mass.

Roach & Co., Inc., Joseph H., Bridgeport, Pa.

Under-feed Stoker Co. of America, Harris Trust Bldg., Chicago, Ill.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STONES, SHARPENING

Carborundum Co., Niagara Falls, N. Y. *See page 248*

Norton Co., Worcester, Mass. *See page 249*

Oil

Superior Corundum Wheel Co., Waltham, Mass.

STOPPER HEADS, GRAPHITE

McCullough-Dalzell Crucible Co., Pittsburgh, Pa.

Seidel, Inc., R. B., 1322 Callowhill St., Philadelphia, Pa.

Sto

STOVES, HOT BLAST

Mohr & Sons, John, 349-350 W. Illinois St., Chicago, Ill. *See page 51*

STRAINERS**Oil**

Anthony Co., 138 West Ave., Long Island City, N. Y. *See page 264*

Self Cleaning Strainer Co., 6329 Stewart Ave., Chicago, Ill.

Steam

Mueller Mfg. Co., H., Decatur, Ill.

Self Cleaning Strainer Co., 6329 Stewart Ave., Chicago, Ill.

Water

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Elliot Co., 6915 Susquehanna St., Pittsburgh, Pa.

Lagonda Mfg. Co., Springfield, O.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Self Cleaning Strainer Co., 6329 Stewart Ave., Chicago, Ill.

Water (Traveling)

*Chain Belt Co., 734 Park St., Milwaukee, Wis. *See pages 176, 177*

*Link-Belt Co., Chicago, Ill. *See page 178*

STRUCTURAL STEEL WORK

Beach Mfg. Co., Charlotte, Mich.

Bergen Point Iron Works, West 5th St., Bayonne, N. J.

Blaw Steel Construction Co., Pittsburgh, Pa.

Canton Bridge Co., Canton, O.

Guarantee Construction Co., 90 West St., New York, N. Y.

Just Co., George A., 239 Vernon Ave., Long Island City, N. Y.

McClintic-Marshall Co., 1217 Oliver Bldg., Pittsburgh, Pa.

Michelmann Steel Construction Co., Quincy, Ill.

Riter-Conley Mfg. Co., Pittsburgh, Pa.

*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

Walsh's Holyoke Steam Boiler Works, Holyoke, Mass.

STUD SETTERS (Opening)

Errington Mechanical Laboratory, 41 Cortlandt St., New York, N. Y.

STUDS

(See Bolts, Stud)

SUGAR MACHINERY

Bartlett Hayward Co., Baltimore, Md.

Hersey Mfg. Co., South Boston, Mass.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Oat & Sons, Joseph, 232 Quarry St., Philadelphia, Pa.

Pratt Engineering & Machine Co., Atlanta, Ga.

Squier Mfg. Co., Geo. L., Buffalo, N. Y.

Stacey-Schmidt Mfg. Co., York, Pa.

Treadwell Co., M. H., 140 Cedar St., New York, N. Y.

Turl Iron & Car Co., Inc., 50 Broad St., New York, N. Y.

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Beet

Kilby Mfg. Co., 4623 Lakeside Ave., Cleveland, O.

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

Swenson Evaporator Co., 945 Monadnock Bldg., Chicago, Ill. *See page 300*

SUPERHEATER PIPES (Seamless Steel)

Pittsburgh Steel Products Co., Pittsburgh, Pa.

SUPERHEATERS, STEAM

*Babcock & Wilcox Co., 85 Liberty St., New York, N. Y. *See pages 34, 35, 36, 37*

*Heine Safety Boiler Co., St. Louis, Mo.

*Power Specialty Co., 111 Broadway, New York, N. Y.

*Superno Co., Inc., 301 Elks Temple, Detroit, Mich.

*Superno Co., Inc., 52 Broadway, New York, N. Y.

Uniflow Boiler Co., Inc., 2 S. 15th St., Philadelphia, Pa.

Locomotive

Locomotive Superheater Co., 30 Church St., New York, N. Y.

*Superno Co., Inc., 301 Elks Temple, Detroit, Mich.

*Superno Co., Inc., 52 Broadway, New York, N. Y.

Marine

*Superno Co., Inc., 301 Elks Temple, Detroit, Mich.

*Superno Co., Inc., 52 Broadway, New York, N. Y.

SWAGING MACHINES

Excelsior Needle Co., Torrington, Conn.

SWITCHBOARDS

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.

Condit Electrical Mfg. Co., South Boston, Mass.

Electric Machinery Co., Minneapolis, Minn.

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Kester Electric Co., 1000-1020 S. 14th St., Terre Haute, Ind.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES**Electric**

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.

Condit Electrical Mfg. Co., South Boston, Mass.

Detroit Fuse & Mfg. Co., 1400-1414 Rivard St., Detroit, Mich.

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Johns-Pratt Co., 555 Capitol Ave., Hartford, Conn.

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Selective (Pyrometer)

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*

Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*

SWITCHES AND FROGS, RAILROAD

Bethlehem Steel Co., South Bethlehem, Pa.

Falk Co., Milwaukee, Wis. *See pages 138, 139*

SWITCHSTANDS, RAILROAD

Bethlehem Steel Co., South Bethlehem, Pa.

SYRUP MACHINERY

Red Wing Iron Works, Red Wing, Minn.

T**TACHOMETERS (Indicating, Recording)**

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*

*Bristol Co., Waterbury, Conn. *See page 327*

Brown Instrument Co., Philadelphia, Pa. *See page 328*

Electric Tachometer Corp'n, Perry Bldg., Philadelphia, Pa.

Advertisements of firms marked * appear in The Journal, A. S. M. E.

- *Foxboro Co., Foxboro, Mass.
 Lombard Governor Co., Ashland, Mass.
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*
 Schuchardt & Schutte, 90 West St., New York, N. Y.
 *Veeder Mfg. Co., Hartford, Conn. *See page 341*
 *Weston Electrical Instrument Co., Waverly Park, Newark, N. J. *See page 333*
 Wilson-Maeulen Co., 781 E. 142nd St., New York, N. Y.

Electro-Magnetic

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*

Vibrating-Reed

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*

TACHOSCOPES

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*
 Schuchardt & Schutte, 90 West St., New York, N. Y.

TACK MACHINERY

Perkins Co., Henry, Bridgewater, Mass.

TACKLE BLOCKS

(See Blocks, Tackle)

TAMPING MACHINES (Trench)

Lourie Mfg. Co., Springfield, Ill.

TANK WORK (Air, Gas, Oil and Water)

Bass Foundry & Machine Co., Fort Wayne, Ind. *See page 39*

Bath Iron Works, Ltd., Bath, Me.

*Bigelow Co., 76 River St., New Haven, Conn. *See page 40*

Birmingham Boiler Works, Birmingham, Ala.

Brennan & Co., John, Detroit, Mich.

Butler Mfg. Co., Kansas City, Mo.

Casey-Hedges Co., Chattanooga, Tenn. *See pages 42, 43*

Cave Welding & Mfg. Co., 32 Liberty St., Springfield, Mass.

Coatesville Boiler Works, Coatesville, Pa.

Codd Co., E. J., 700-708 S. Caroline St., Baltimore, Md.

Dover Boiler Works, 50 Church St., New York, N. Y.

Farrar & Trefts, 54-66 Perry St., Buffalo, N. Y.

Frost Mfg. Co., Galesburg, Ill.

*Graver Tank Works, Wm., East Chicago, Ind.

Hammond Iron Works, Warren, Pa.

Honhorst Co., Jos., Cincinnati, O.

Houston, Stanwood & Gamble Co., Cincinnati, O. *See pages 46, 47*

*Keeler Co., E., Williamsport, Pa. *See page 45*

Kittoe Boiler & Tank Co., Canton, O.

Koven & Brother, L. O., Jersey City, N. J. *See page 301*

La Crosse Boiler Co., La Crosse, Wis.

Lookout Boiler & Mfg. Co., Chattanooga, Tenn.

McAleenan Bros. Co., Pittsburgh, Pa.

McDermott Engineering Co., Whitehall & Jordan Sts., Allentown, Pa.

McEwen Bros., Wellsville, N. Y.

McNaull Boiler Mfg. Co., Toledo, O.

McNeil & Bro. Co., James, Pittsburgh, Pa.

Michelman Steel Construction Co., Quincy, Ill.

Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. *See page 50*

Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*

Morrison Bros., Dubuque, Ia.

Munroe & Sons, R., 23rd & Smallman Sts., Pittsburgh, Pa.

Murray Iron Works Co., Burlington, Ia. *See page 16*

New York Central Iron Works Co., Inc., Hagerstown, Md.

Pennsylvania Boiler Works, Erie, Pa.
 Petroleum Iron Works Co., Sharon, Pa.
 Phoenix Iron Works Co., Meadville, Pa. *See page 53*

Pickham Boiler Co., 3035 W. Jackson Blvd., Chicago, Ill.

Reeves Bro. Co., Alliance, O.

Remington Machine Co., Wilmington, Del.

Riter-Conley Mfg. Co., Pittsburgh, Pa.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.

*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

Shofield's Sons Co., J. S., Macon, Ga.

Smith & Son Co., Sam'l, Paterson, N. J.

Steady-Schmidt Mfg. Co., York, Pa.

Stewart Boiler Works, Worcester, Mass.

Struthers Wells Co., Warren, Pa.

Treadwell Construction Co., Midland, Pa.

Treadwell Co., M. H., 140 Cedar St., New York, N. Y.

Turl Iron & Car Co., Inc., 50 Broad St., New York, N. Y.

Union Boiler Mfg. Co., Lebanon, Pa.

United Iron Works Co., Iola, Kan.

Vogt Machine Co., Henry, Louisville, Ky. *See page 55*

Walsh & Weidner Boiler Co., Chattanooga, Tenn.

Warren City Tank & Boiler Co., Warren, O. Wetherill & Co., Inc., Robt., Chester, Pa. *See page 19*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

TANKS**Acid**

Cole Mfg. Co., R. D., Newman, Ga.

Warren City Tank & Boiler Co., Warren, O.

Aluminum

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

Copper

Koven & Brother, L. O., Jersey City, N. J. *See page 301*

Gasoline Storage

Buckeye Boiler Co., 1617 McLain St., Dayton, O.

*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

Glass Enameled

Elyria Enameled Products Co., Elyria, O.

Paint and Varnish

Buckeye Boiler Co., 1617 McLain St., Dayton, O.

Pressure

American Welding Co., Carbondale, Pa.

Ruemmel-Dawley Mfg. Co., 3900 Chouteau Ave., St. Louis, Mo.

*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

Wood Mfg. Co., John, Conshohocken, Pa.

Railroad (Locomotive)

Chicago Bridge & Iron Works, 37 W. Van Buren St., Chicago, Ill.

Septic

Morrison Bros., Dubuque, Ia.

Sprinkler

Chicago Bridge & Iron Works, 37 W. Van Buren St., Chicago, Ill.

Storage

Chicago Bridge & Iron Works, 37 W. Van Buren St., Chicago, Ill.

Milwaukee Boiler Co., 220 Oregon St., Milwaukee, Wis. *See page 50*

Morrison Bros., Dubuque, Ia.

Phoenix Iron Works Co., Meadville, Pa. *See page 53*

*Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

Tan

See Catalogue Section for data of firms listed in bold face type

TANKS (continued)**Storage**

Standard Boiler & Plate Iron Co., Nilis, O.
 Struthers Wells Co., Warren, Pa.
 United Iron Works Co., Springfield, Mo.
 Warren City Tank & Boiler Co., Warren, O.
 Wayne Oil Tank & Pump Co., Fort Wayne, Ind.
 Willcox Engineering Co., Saginaw, Mich. *See page 317*
 Wilson Steam Boiler Co., 1919-27 S. 20th St., Omaha, Neb.

Tower

Cole Mfg. Co., R. D., Newman, Ga.

Welded

American Welding Co., Carbondale, Pa.
 Devine Co., J. F., Buffalo, N. Y. *See pages 298, 299*
 Elyria Enamelled Products Co., Elyria, O.
 Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*
 Phoenix Iron Works Co., Meadville, Pa. *See page 53*
 *Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*
 Willcox Engineering Co., Saginaw, Mich. *See page 317*
 Wood Mfg. Co., John, Conshohocken, Pa.

TANNERS' MACHINERY

Slocumb & Co., Inc., F. F., Wilmington, Del.

TAP EXTENSIONS

Allen Mfg. Co., Hartford, Conn.

TAPPING ATTACHMENTS

Ricknell-Thomas Co., Greenfield, Mass.
 McCrosky Reamer Co., Meadville, Pa. *See pages 246, 247*
 Modern Tool Co., Erie, Pa. *See page 244*
 Peter Bros. Mfg. Co., Algonquin, Ill.
 Roeper Crane & Hoist Works, Reading, Pa.

TAPPING MACHINES

Acme Machinery Co., Cleveland, O.
 Brown Co., H. B., East Hampton, Conn.
 Burke Machine Tool Co., Conneaut, O.
 Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn. *See page 237*
 Harvey Hubbell, Inc., State St. & Bostwick Ave., Bridgeport, Conn.
 Modern Tool Co., Erie, Pa. *See page 244*
 Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.
 Paragon Gear Works, Taunton, Mass.
 Peter Bros. Mfg. Co., Algonquin, Ill.
 Pottstown Machine Co., Pottstown, Pa.
 St. Louis Machine Tool Co., 2007 S. Broadway, St. Louis, Mo.

Multiple Head

Moline Tool Co., 319-20th St., Moline, Ill.
 Williams, White & Co., Moline, Ill. *See page 216*

Turret

Quint Turret Drill Works, 8 Clinton St., Hartford, Conn.

TAPPING AND VALVE INSERTING MACHINES (Water)

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

TAPS, COLLAPSING

Geometric Tool Co., New Haven, Conn.
 Modern Tool Co., Erie, Pa. *See page 244*

TAPS AND DIES

American Tap & Die Co., Greenfield, Mass.
 Brubaker & Bros., W. L., 50 Church St., New York, N. Y.
 Butterfield & Co., Inc., Derby Line, Vt.
 Card Mfg. Co., S. W., Mansfield, Mass.
 *Greenfield Tap and Die Corp'n, Greenfield, Mass.
 Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn. *See page 237*
 Modern Tool Co., Erie, Pa. *See page 244*

Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.
 Pipe Machinery Co., 4907 Mead Ave., Cleveland, O.
 Wells & Son Co., F. E., Greenfield, Mass.
 Winter Bros. Co., Wrentham, Mass.

TELPHERS

(See Tramrail Systems, Overhead)

TEMPERATURE REGULATORS

(See Regulators, Temperature)

TESTING MACHINES

Holz, Herman A., 50 Church St., New York, N. Y.
 Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*
 Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

Consistency, Bituminous Materials

Chatillon & Sons, John, 85-93 Cliff St., New York, N. Y. *See page 315*

TEXTILE MACHINERY

Tillotson Humidifier Co., Providence, R. I.
 Trump Bros. Machine Co., Beech & Anchor-age Sts., Wilmington, Del.

THERMOCOUPLES

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*

Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*

THERMOMETERS (Indicating, Recording)

American Apparatus Corp'n, 9-11 E. 16th St., New York, N. Y. *See page 334*
 American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 *Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*
 Berg Mfg. Co., James., 3707 12th Ave., Brooklyn, N. Y.

*Bristol Co., Waterbury, Conn. *See page 327*

Brown Instrument Co., Philadelphia, Pa. *See page 328*

Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*

*Defender Automatic Regulator Co., 506 Oriol Bldg., St. Louis, Mo. *See page 319*

DuViver, Ernest H., 30 Church St., New York, N. Y.

Eimer & Amend, 205-211 Third Ave., New York, N. Y. *See page 335*

*Foxboro Co., Foxboro, Mass.
 Green, Henry J., 1191 Bedford Ave., Brooklyn, N. Y.

National Gauge Co., 300 Pacific St., Brooklyn, N. Y.

Queen-Gray Co., 616-620 Chestnut St., Philadelphia, Pa.

Quimby Engineering Co., 915 Ridge Ave., Philadelphia, Pa.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*

Standard Thermometer Co., 65 Shirley St., Boston, Mass.

Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. *See page 330*

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*

Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*

Wagner, Carl H., 1944 N. Albany Ave., Chicago, Ill.

Distance (Electric Resistance)

*Bristol Co., Waterbury, Conn. *See page 327*

Eimer & Amend, 205-211 Third Ave., New York, N. Y.

Engelhard, Charles, 30 Church St., New York, N. Y.

Hanovia Chemical & Mfg. Co., Chestnut St. & N. J. Railroad Ave., Newark, N. J.

Leeds & Northrup Co., Philadelphia, Pa.

*Taylor Instrument Cos., Rochester, N. Y. *See page 331*

Thwing Instrument Co., 436 N. 5th St., Philadelphia, Pa. *See page 332*

Tan

High Range

Dwight Mfg. Co., 12-14 So. Jefferson St., Chicago, Ill.
 Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y. *See page 329*
 *Taylor Instrument Cos., Rochester, N. Y. *See page 331*

THERMOSTATS

American Thermostat Co., 101 Mechanic St., Newark, N. J.
 Jewell Mfg. Co., Auburn, N. Y.
 Johnson Service Co., Milwaukee, Wis.
 National Regulator Co., 208 S. Jefferson St., Chicago, Ill.
 Powers Regulator Co., 5 South Wabash Ave., Chicago, Ill.
 *Sarco Co., Inc., Woolworth Bldg., New York, N. Y.
 Standard Thermometer Co., 65 Shirley St., Boston, Mass.

THICKENERS

Dorr Co., 1009 17th St., Denver, Colo.

THREAD CUTTING TOOLS

Chicago Automatic Machine Co., 400-408 N. Oakley Blvd., Chicago, Ill.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Eastern Machine Screw Corp., New Haven, Conn.
 Geometric Tool Co., New Haven, Conn.
 *Greenfield Tap and Die Corp., Greenfield, Mass.
 Ideal Tool & Mfg. Co., Beaver Falls, Pa.
 *Jones & Lamson Machine Co., Springfield, Vt. *See pages 220, 221, 222, 223*
 Loew Mfg. Co., 9001 Madison Ave., N. W., Cleveland, O.
 Modern Tool Co., Erie, Pa. *See page 244*
 Reed Mfg. Co., Erie, Pa.
 Rivett Lathe & Grinder Co., Brighton, Boston, Mass.
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
 Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, O.
 Wells & Son Co., F. E., Greenfield, Mass.

THREADING MACHINES (Sheet Metal)
 V & O Press Co. (Glendale), Brooklyn, N. Y.

TICKET-CANCELLING MACHINES

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*

TIERING MACHINES, PORTABLE

Economy Engineering Co., 415 S. Washtenaw Ave., Chicago, Ill.
 N. Y. Revolving Portable Elevator Co., 343-351 Garfield Ave., Jersey City, N. J. *See page 183*

TIES, STEEL (Mine)

Fairmont Mining Machinery Co., Fairmont, W. Va.

TILES

Asphalt

Hastings Pavement Co., 25 Broad St., New York, N. Y. *See page 270*

Hollow

Maurer & Son, Henry, 420 E. 23rd St., New York, N. Y.

TILE MACHINERY

Arnold Creager Co., New London, O.

TIME DETECTORS, WATCHMEN'S

Newman Clock Co., 178 Fulton St., New York, N. Y. *See page 336*

TIME RECORDERS

Baird Equipment Co., 319-25 W. Ohio St., Chicago, Ill.
 *Bristol Co., Waterbury, Conn. *See page 327*
 Brown Instrument Co., Philadelphia, Pa. *See page 328*
 Gisholt Machine Co., Madison, Wis.
 Newman Clock Co., 178 Fulton St., New York, N. Y. *See page 336*

Simplex Time Recorder Co., Gardner, Mass.
 Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y. *See page 337*
 Wilcox Engineering Co., Saginaw, Mich. *See page 317*

TIN, SHEET

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

TINSMITHS' TOOLS AND MACHINES

Niagara Machine & Tool Works, Buffalo, N. Y. *See page 214*

TINWARE MACHINERY

Bliss Co., E. W., 19 Adams St., Brooklyn, N. Y. *See page 212*

TIRE SETTING MACHINES (Hydraulic)

Lourie Mfg. Co., Springfield, Ill.

TIRE WELDING MACHINES

Long & Allstatter Co., Hamilton, O. *See page 213*
 Williams, White & Co., Moline, Ill. *See page 215*

TOBACCO MACHINERY

American Machine & Foundry Co., 2250 Second Ave., Brooklyn, N. Y.
 Miller, DuBrul & Peters Mfg. Co., 507 E. Pearl St., Cincinnati, O.

TONGS, CRUCIBLE

New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*

TOOL POSTS (Turret)

McCroskey Reamer Co., Meadville, Pa. *See pages 246, 247*

TOOLS

Boiler Makers'

Faessler Mfg. Co., J., Moberly, Mo.

Boiler Repairers'

Faessler Mfg. Co., J., Moberly, Mo.

Boring

Kelly Reamer Co., 1555 Columbus Road, Cleveland, O.
 McCroskey Reamer Co., Meadville, Pa. *See pages 246, 247*
 Schellenbach-Kuntz Tool Co., 120 Opera Place, Cincinnati, O.
 Union Tool Co., Orange, Mass.

Boring (Adjustable and Expansion)

Davis Boring Tool Co., 3722 Forest Park Blvd., St. Louis, Mo.
 Kelly Reamer Co., 1555 Columbus Road, Cleveland, O.
 McCroskey Reamer Co., Meadville, Pa. *See pages 246, 247*

Brass-Working Machine

*Warner & Swasey Co., Cleveland, O. *See page 225*
 Wood Turret Machine Co., Brazil, Ind.

Broaching

Lapointe Machine Tool Co., Hudson, Mass.

Edge

Plumb, Inc., Fayette R., Bricksburg P. O., Philadelphia, Pa.

Lathe

Acme Machine Tool Co., Cincinnati, O. *See page 218*
 Ready Tool Co., Bridgeport, Conn.

Machinist's Small

Atlas Ball Co., Glenwood Ave at 4th St. Philadelphia, Pa. *See page 159*
 Brown & Sharpe Mfg. Co., Providence, R. I.
 Millholland Machine Co., W. K., Indianapolis, Ind.
 Plumb, Inc., Fayette R., Bricksburg P. O., Philadelphia, Pa.
 Pratt & Whitney Co., Hartford, Conn.
 Union Tool Co., Orange, Mass.

See Catalogue Section for data of firms listed in bold face type

TOOLS (continued)

Planer

Cincinnati Planer Co., Oakley, Cincinnati, O.
See page 228

Pneumatic

*Ingersoll-Rand Co., 11 Broadway, New York, N. Y. See pages 272, 273
Oldham & Son Co., Geo., 4316 Tackawanna St., Frankford, Philadelphia, Pa.

Power (Portable)

Stow Flexible Shaft Co., Philadelphia, Pa.
Stow Mfg. Co., 443 State St., Binghamton, N. Y.

Punch Press

McCall Machine Works, Rochester, N. Y.

Railroad Track

National Standard Co., Niles, Mich.

Refacing (Pump Valve)

Furness Bros. Co., 1615 W. Walnut St., Chicago, Ill.

Special

Black & Decker Mfg. Co., 105-15 S. Calvert St., Baltimore, Md.
Boeger-Meyer Machine & Tool Co., 59-65 McWhorter St., Newark, N. J.
*Crowdrey Machine Works, C. H., Fitchburg, Mass. See page 236
Grant Mfg. & Machine Co., Bridgeport, Conn.
Hartford Engine Works, 223 State St., Hartford, Conn.
Harris Engineering Co., H. E., 1041-1055 Broad St., Bridgeport, Conn. See page 237
Heartley Machine, Variety Iron & Tool Works, 900-908 Summit St. Cor. Locust, Toledo, O.
Holland Machine Co., 90 W. Broadway, New York, N. Y.
Mehl Machine, Tool & Die Co., Roselle, N. J. See pages 238, 239
Sloan & Chace Mfg. Co., Ltd., 6th Ave. Cor. N. 13th St., Newark, N. J. See page 233
Slocum, Avram & Slocum Laboratories, Inc., New York, N. Y. See page 337
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Toledo Drill & Tool Co., Toledo, O.
Torrington Mfg. Co., Torrington, Conn. See page 240

Valve Reseating

Lockett & Co., Ltd., A. M., New Orleans, La.
Skinner & Co., M. B., 562 Washington Blvd., Chicago, Ill.

TORCHES

*Best, Inc., W. N., 11 Broadway, New York, N. Y. See page 265
Gem Mfg. Co., 1229-43 Goebel St., N. S., Pittsburgh, Pa.
Hauck Mfg. Co., 140 Livingston St., Brooklyn, N. Y.
Selas Co., 521 W. 23rd St., New York, N. Y. See page 267

TRACK

Cast Iron Plate

Washburn & Granger, 50 Church St., New York, N. Y. See page 72

Industrial Railway

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. See pages 186, 187
Orenstein-Arthur Koppel Co., Canton, O.
Sackett Screen & Chute Co., H. B., 1679-1693 Elston Ave., Chicago, Ill.
Simplex Surface Contact Co., Williamsport, Pa.
Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. See page 196
Washburn & Granger, 50 Church St., New York, N. Y. See page 72

Overhead

Coburn Trolley Track Mfg. Co., Holyoke, Mass.
New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. See page 193

TRACK WORK, SPECIAL

Bethlehem Steel Co., South Bethlehem, Pa.
Falk Co., Milwaukee, Wis. See pages 138, 139
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

TRACTORS

Anderson Engine Co., 4036 N. Rockwell St., Chicago, Ill.
Buckeye Mfg. Co., Anderson, Ind.
Buffalo Pitts Co., Carolina & Fourth Sts., Buffalo, N. Y.
Dayton-Dick Co., Quincy, Ill.
Hart-Parr Co., Charles City, Ia.
Holt Mfg. Co., Stockton, Cal.
International Harvester Co. of America, Harvester Bldg., Chicago, Ill.
Lanson Mfg. Co., John, New Halstein, Wis.
Mayer Bro. Co., Mankato, Minn.
Phoenix Mfg. Co., Eau Claire, Wis.
Weber Engine Co., Kansas City, Mo.
Weir & Craig Mfg. Co., 2437 Wallace St., Chicago, Ill.

Electric (Storage Battery)

Elwell-Parker Electric Co., Cleveland, O.

TRAMRAIL SYSTEMS (Overhead)

*Box & Co., Alfred, Philadelphia, Pa.
*Brown Hoisting Machinery Co., Cleveland, O.
Browning & Co., Victor R., 17701 Lake Shore Blvd., Cleveland, O.
Cameron Engineering Co., East Stroudsburg, Pa.
*Link-Belt Co., Chicago, Ill. See page 178
New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. See page 193
Philadelphia Tramrail Co., Front & Tusculum Sts., Philadelphia, Pa. See page 194
Richards-Wilcox Mfg. Co., Aurora, Ill.
Ricker Mfg. Co., 239 N. Water St., Rochester, N. Y.
*Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. See page 192
Whitehead & Kales Iron Works, Beecher Ave. & M. C. R. R., Detroit, Mich.

TRAMWAYS

Bridge

*Hunt Co., Inc., C. W., West New Brighton, Staten Island, N. Y. See pages 186, 187
*Link-Belt Co., Chicago, Ill. See page 178
*Toledo Bridge & Crane Co., Toledo, O.

Bridge (Electric)

Maine Electric Co., 35 Commercial St., Portland, Me.

Wire Rope

American Steel & Wire Co., 72 W. Adams St., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
*Clyde Iron Works, 29th Ave. West & Michigan St., Duluth, Minn. See page 190
Leschen & Sons Rope Co., A., St. Louis, Mo.
*Roebling's Sons Co., John A., Trenton, N. J. See page 172

TRANSFER TABLES

Industrial Works, Bay City, Mich. See page 189

TRANSFORMATION POINT APPARATUS (Steel)

Leeds & Northrup Co., Philadelphia, Pa.

TRANSFORMERS, ELECTRIC

Adams Bagnall Electric Co., Cleveland, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
*Crocker-Wheeler Co., Ampere, N. J. See page 32
*General Electric Co., Schenectady, N. Y. See pages 30, 31

Too

Wagner Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TRANSMISSION MACHINERY (See Power Transmission Machinery)

TRANSMISSION TOWERS
 Blaw Steel Construction Co., Pittsburgh, Pa.

TRANSMISSIONS

Automobile

Brown-Lipe Gear Co., 1117 West Fayette St., Syracuse, N. Y.
 Detroit Gear & Machine Co., 127 Franklin St., Detroit, Mich.
 Warner Gear Co., Muncie, Ind.

Marine

Paragon Gear Works, Taunton, Mass.

Right Angle

Almond Mfg. Co., T. R., Ashburnham, Mass.

TRAPS

Radiator

Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*

Return

American Blower Co., Detroit, Mich. *See pages 280, 281*

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 108*

Farnsworth Mfg. Co., 65 Beverly St., Boston, Mass.

Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*

Lytton Mfg. Corp'n, Franklin, Va.

*Morehead Mfg. Co., Detroit, Mich.

Nashua Machine Co., Nashua, N. H.

Roy's Heat Control Co., 915 Gates Ave., Brooklyn, N. Y.

Sorge, Jr. & Co., A., Monadnock Block, Chicago, Ill.

Taylor Steam Specialty Co., Battle Creek, Mich. *See page 114*

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

Steam

Albany Steam Trap Co., 317 N. Pearl St., Albany, N. Y.

American Blower Co., Detroit, Mich. *See pages 280, 281*

American District Steam Co., North Tonawanda, N. Y. *See page 118*

American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 122*

Anderson Co., V. D., W. 96th St., Cleveland, O.

Armstrong Machine Works, Three Rivers, Mich.

Automatic Steam Trap Specialty Co., 2707 Vestry Ave., Cleveland, O.

Bishop-Babcock-Becker Co., Cleveland, O.

Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.

Burrows Mfg. Co., 41-45 N. Water St., York, Pa.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

*Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.

D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 108*

D. G. C. Trap & Valve Co., Inc., 81 E. 41st St., New York, N. Y.

Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*

Farnsworth Mfg. Co., 65 Beverly St., Boston, Mass.

Flinn, Richard J., West Roxbury, Mass.

Foskett & Bishop Co., New Haven, Conn.

Hornung, J. C., 343 S. Dearborn St., Chicago, Ill.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

*Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*

Kitts Steam Specialty Co., 60 E. 1st St., Oswego, N. Y.

Lytton Mfg. Corp'n, Franklin, Va.

Marvin & Casler Co., Canaan, N. Y.

Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

*Morehead Mfg. Co., Detroit, Mich.

Nashua Machine Co., Nashua, N. H.

Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.

Ohio Blower Co., Cleveland, O.

Open Coil Heater & Purifier Co., Indianapolis, Ind.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Plant Engineering & Equipment Co., Inc., 6 Church St., New York, N. Y.

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

*Sarco Co., Inc., Woolworth Bldg., New York, N. Y.

Squires Co., C. E., Cleveland, O.

Steam Appliance Co., West Allis, Wis.

Taylor Steam Specialty Co., Battle Creek, Mich. *See page 114*

Tillotson Humidifier Co., Providence, R. I.

Vance-Vetter Co., First National Bank Bldg., Pittsburgh, Pa.

Watson & McDaniel Co., 146 N. Seventh St., Philadelphia, Pa.

Watts Regulator Co., 250-252 Lowell St., Lawrence, Mass.

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

Western Kieley Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.

Williams Gauge Co., 543 Fourth Ave., Pittsburgh, Pa.

Williams Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.

Vacuum

American Blower Co., Detroit, Mich. *See pages 280, 281*

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*

Flinn, Richard J., West Roxbury, Mass.

Lytton Mfg. Corp'n, Franklin, Va.

Marsh & Co., Jas. P., 118-124 S. Clinton St., Chicago, Ill.

*Morehead Mfg. Co., Detroit, Mich.

Nashua Machine Co., Nashua, N. H.

Open Coil Heater & Purifier Co., Indianapolis, Ind.

Peerless Engineering Co., 1253-38 S. Dearborn St., Chicago, Ill.

Rochester Vacuum Valve Co., Rochester, N. Y.

Strong, Carlisle & Hammond Co., 326-344 Frankfort Ave., N. W., Cleveland, O.

Taylor Steam Specialty Co., Battle Creek, Mich. *See page 114*

Webster & Co., Warren, Camden, N. J. *See pages 80, 81, 82, 83*

TRENCH-DIGGING MACHINERY

Potter Mfg. Co., 3511 E. Washington St., Indianapolis, Ind.

TRIMMING MACHINES (Tin Plate)

Aetna Foundry & Machine Co., Warren, O.

TROLLEYS

Chisholm-Moore Mfg. Co., Cleveland, O.

*Ford Chain Block & Mfg. Co., 139 W. Oxford St., Philadelphia, Pa. *See page 195*

Franklin Moore Co., Winsted, Conn.

*Link-Belt Co., Chicago, Ill. *See page 178*

See Catalogue Section for data of firms listed in bold face type

TROLLEYS (continued)

New Jersey Foundry & Machine Co., 88 West St., New York, N. Y. *See page 193*
Nuttall Co., R. D., Pittsburgh, Pa. *See page 137*
Philadelphia Tramrail Co., Front & Tusculum Sts., Philadelphia, Pa. *See page 194*
Reading Chain Block Co., Reading, Pa.
Richards-Wilcox Mfg. Co., Aurora, Ill.
Round & Son, D., Cleveland, O.
***Shepard Electric Crane & Hoist Co.**, Montour Falls, N. Y. *See page 192*
Wright Mfg. Co., Lisbon, O.

TRUCKS**Car Mine**

Day Iron Works, Sanford, Knoxville, Tenn.
Ottumwa Iron Works, Ottumwa, Ia.

Dry Kiln

American Blower Co., Detroit, Mich. *See pages 280, 281*

Elevating

Cowan Truck Co., Holyoke, Mass.
National Scale Co., Chicopee Falls, Mass.
Plimpton Elevating Truck, 70 Fifth Ave., New York, N. Y.
Transmission Ball Bearing Co., Inc., 32 Wells St., Buffalo, N. Y.

Factory

***American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*
Chase Foundry & Mfg. Co., Columbus, O.
Clark Co., George P., Windsor Locks, Conn.
Fairbanks Co., 416 Broome St., New York, N. Y.
Howe Scale Co. of N. Y., 341 Broadway, New York, N. Y.
Johnston Co., Wm. T., Cincinnati, O.
McKinney Mfg. Co., Pittsburgh, Pa.
Plimpton Elevating Truck, 70 Fifth Ave., New York, N. Y.
Standard Scale & Supply Co., Pittsburgh, Pa.

Industrial (Storage Battery)

Baldwin Locomotive Works, Philadelphia, Pa.
Buda Co., Railway Exchange Bldg., Chicago, Ill.
Elwell-Parker Electric Co., Cleveland, O.
***General Electric Co.**, Schenectady, N. Y. *See pages 30, 31*
General Vehicle Co., Inc., Long Island City, N. Y.
***Hunt Co., Inc.**, C. W., West New Brighton, Staten Island, N. Y. *See pages 186, 187*
Moore & Sons Corp'n, Samuel L., Elizabeth, N. J.

Motor

(See Motor Trucks)

Trailer

Baldwin Locomotive Works, Philadelphia, Pa.

TUBE CLEANERS, BOILER

General Specialty Co., 291-295 Michigan Ave., Buffalo, N. Y.
Lagonda Mfg. Co., Springfield, O.
Liberty Mfg. Co., 6907 Susquehanna St., Pittsburgh, Pa.
Monarch Steam Blower Co., Troy, N. Y.
Pierce Co., William B., 45 N. Division St., Buffalo, N. Y.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Roto Co., Hartford, Conn.

TUBE MILL MACHINERY

Torrington Mfg. Co., Torrington, Conn. *See page 240*

Seamless

Standard Engineering Co., Ellwood City, Pa.

TUBE MILL WEARING PARTS

Chrome Steel Works, Chrome, N. J.

TUBE ROLLING MACHINES

Garrigus Machine Co., C. G., Bristol, Conn.

TUBE WORKS EQUIPMENT

United Engineering & Foundry Co., Farmers Bank Bldg., Pittsburgh, Pa.

TUBES**Ball and Roller Bearing**

Ohio Seamless Tube Co., Shelby, O.

Boiler

Detroit Seamless Steel Tubes Co., 841 Jefferson Ave., W., Detroit, Mich.
Mark Mfg. Co., Evanston, Ill.
Monongahela Tube Co., Pittsburgh, Pa. *See page 59*

***Parkesburg Iron Co.**, Parkesburg, Pa.
Reliance Tube Co., Ltd., 803 Second Natl. Bank Bldg., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.
South Chester Tube Co., Chester, Pa.

Boiler (Charcoal Iron)

Monongahela Tube Co., Pittsburgh, Pa. *See page 59*

***Parkesburg Iron Co.**, Parkesburg, Pa.

Boiler (Seamless Steel)

Pittsburgh Steel Products Co., Pittsburgh, Pa.

Boiler (Soft Steel)

Allegheny Steel Co., Pittsburgh, Pa.
Monongahela Tube Co., Pittsburgh, Pa. *See page 59*

Condenser

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

Bridgeport Brass Co., Bridgeport, Conn.

Pneumatic Despatch

Lamson Co., 100 Boylston St., Boston, Mass. *See pages 184, 185*
Miles Co., George, Winsted, Conn.
Universal Tube Co., 142-152 W. Ohio St., Chicago, Ill.

TUBING**Alloy**

Ohio Seamless Tube Co., Shelby, O.

Aluminum

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

Ivins Tube Works, Ellwood, Oak Lane Station, Philadelphia, Pa.

Brass and Copper

Phenix Tube Co., 182 N. 11th St., Brooklyn, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Sandusky Foundry & Machine Co., Sandusky, O.

Brass and Copper (Seamless)

American Brass Co., Waterbury, Conn. *See page 204*

Bridgeport Brass Co., Bridgeport, Conn.
Chase Rolling Mill Co., Waterbury, Conn.
***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
Erie-Buffalo Tube Co., 1227 W. 18th St., Erie, Pa.
Rutter, Arthur T., 256-257 Broadway, New York, N. Y.

Canvas (Air)

Bemis Bro. Gag Co., St. Louis, Mo

Fibre

***American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*
Diamond State Fibre Co., Bridgeport, Conn.

Flexible Metal

Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Hose Co., Waterbury, Conn. *See page 132*
Pennsylvania Flexible Metallic Tubing Co., N. E. Cor. Broad & Race Sts., Philadelphia, Pa.
U. S. Flexible Metallic Tubing Co., 430 Boyd St., Los Angeles, Cal.

Tro

Lead

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Oil Well

Monongahela Tube Co., Pittsburgh, Pa. *See page 59*

Rubber

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
 *Goodrich Co., B. F., Akron, O. *See pages 133, 165*
 Mechanical Rubber Co., Cleveland, O. *See page 169*

Steel

Carpenter Steel Co., Reading, Pa.
 Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*
 Phenix Tube Co., 182 N. 11th St., Brooklyn, N. Y.
 Standard Welding Co., W. 73rd & N. Y. C. Tracks, Cleveland, O.

Steel (Seamless)

Detroit Seamless Steel Tubes Co., 841 Jefferson Ave., W., Detroit, Mich.
 Ivins' Tube Works, Ellwood, Oak Lane Station, Philadelphia, Pa.
 National Tube Co., Pittsburgh, Pa.
 Pittsburgh Steel Products Co., Pittsburgh, Pa.
 Ward's Sons, Edgar T., 50 Farnsworth St., Boston, Mass. *See page 209*

TUBULAR PARTS (Bent)

American Tube Bending Co., New Haven, Conn.
 Standard Welding Co., W. 73rd & N. Y. C. Tracks, Cleveland, O.

TUMBLING BARRELS

Abbott Ball Co., Elmwood, Conn.
 Baird Machine Co., Bridgeport, Conn.
 Dayton-Dick Co., Quincy, Ill.
 Globe Machine & Stamping Co., Cleveland, O.
 Mohr & Sons, John, 349-359 W. Illinois St., Chicago, Ill. *See page 51*
 *Roryersford Foundry & Machine Co., 52 N. 5th St., Philadelphia, Pa. *See pages 152, 153*
 Tilghman-Brooksbank Sand Blast Co., 1124 S. 11th St., Phila., Pa.

Burnishing

Baird Machine Co., Bridgeport, Conn.

Sand Blast

American Foundry Equipment Co., 52 Vanderbilt Ave., New York, N. Y.

TURBINES**Hydraulic**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 Jolly, Inc., J. & W., Holyoke, Mass.
 Laffel & Co., James, 501 Lagonda St., Springfield, O.
 *Morris Co., I. P., Philadelphia, Pa. *See page 296*
 Platt Iron Works, Dayton, O. *See page 290*
 Smith Co., S. Morgan, York, Pa.
 Trump Mfg. Co., Springfield, O.
 Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, O.

Steam

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 De Laval Steam Turbine Co., Trenton, N. J.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Kerr Turbine Co., Wellsville, N. Y. *See page 29*
 Rearick, Charles B., 14 Wall St., New York, N. Y.
 Ridgway Dynamo & Engine Co., Ridgway, Pa.
 Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*
 Sturtevant Co., B. F., Hyde Park, Boston, Mass.
 Terry Steam Turbine Co., Hartford, Conn.

Turbine Equipment Co., 50 Church St., New York, N. Y.

*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TURBO-BLOWERS

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*
 *Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
 Worthington Pump & Mch'y. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

TURBO-COMPRESSORS

De Laval Steam Turbine Co., Trenton, N. J.
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 *Ingersoll-Rand Co., 11 Broadway, New York, N. Y. *See pages 272, 273*
 Worthington Pump & Mch'y. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

TURBO-GENERATORS

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 Kerr Turbine Co., Wellsville, N. Y. *See page 29*

Southwark Foundry & Machine Co., Philadelphia, Pa. *See page 24*

TURBO-PUMPS

Rearick, Charles B., 14 Wall St., New York, N. Y.

TURNBUCKLES

Cleveland City Forge & Iron Co., Cleveland, O.
 Merrill Bros., Maspeth, (Queens Borough) New York, N. Y.
 Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. *See page 259*

TURNABLES

American Bridge Co., 30 Church St., New York, N. Y.
 Easton Car & Construction Co., Easton, Pa.
 *Hunt Co., Inc., C. W.; West New Brighton, Staten Island, N. Y. *See pages 186, 187*
 Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*
 Washburn & Granger, 50 Church St., New York, N. Y. *See page 72*

Overhead Track

Philadelphia Tramrail Co., Front & Tusculum Sts., Philadelphia, Pa. *See page 194*

TURRET HEADS (Bench Lathe)

Meisselbach-Catucci Mfg. Co., 29 Congress St., Newark, N. J.

TURRET MACHINES

(See Lathes, Turret)

TWIST DRILLS

(See Drills, Twist)

U**UNDERFEED STOKERS**

(See Stokers, Underfeed)

UNIONS

Athol Pump Co., Athol, Mass.
 Bard Union Co., Inc., Norwich, Conn.
 *Crane Co., 830 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Dart Mfg. Co., E. M., Providence, R. I.
 Eastwood Wire Mfg. Co., Belleville, N. J.
 Jefferson Union Co., Lexington, Mass.
 Kelly & Jones, Co. Greensburg, Pa. *See pages 94, 95*
 Mark Mfg. Co., Evanston, Ill.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

See Catalogue Section for data of firms listed in bold face type

UNIONS (continued)

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*
Stoddard Union Co., Lockport, N. Y.
Williams, Inc., Franklin, 39 Cortlandt St., New York, N. Y.

Flange

Stoddard Union Co., Lockport, N. Y.

Pressed Steel

Rockwood Sprinkler Company of Mass., 34-56 Harlow St., Worcester, Mass.

UNIVERSAL GAGES

(*See Gages, Universal*)

UNLOADERS**Air Compressor**

Gardner Governor Co., Quincy, Ill. *See page 274*
Norwalk Iron Works Co., So. Norwalk, Conn. *See page 275*

***Yarnall-Waring Co.**, Chestnut Hill, Philadelphia, Pa.

Ballast

***Lidgerwood Mfg. Co.**, 96 Liberty St., New York, N. Y. *See page 191*

Portable

Brown Portable Elevator Co., Chicago, Ill. *See page 179*

UPSETTING MACHINES

Williams, White & Co., Moline, Ill. *See page 216*

Tire (with Punch and Shears)

Luther Mfg. Co., Olean, N. Y.

V

Uni VACUUM BREAKERS*

Morton Vacuum Breaker Co., Hyde Park, Boston, Mass.

VACUUM CLEANING MACHINERY

American Radiator Co., Chicago, Ill.
Blaisdell Machinery Co., Bradford, Pa.
Kollin Co., John, 1161-1175 Broadway, New York, N. Y.
Spencer Turbine Cleaner Co., Hartford, Conn.

VACUUM DRYERS, HEATING SYSTEMS, PANS, PUMPS, TRAPS, ETC.

(*See Dryers, Heating Systems, Pans, Pumps, Traps, etc., Vacuum*)

VACUUM DRYING APPARATUS

Buffalo Foundry & Machine Co., E. Ferry St. & Fulmore Ave., Buffalo, N. Y.
Devine Co., J. P., Buffalo, N. Y. *See pages 298, 299*

VALVE BALLS

Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y. *See page 154*
Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
Goodrich Co., B. F., Akron, O. *See pages 133, 165*

VALVE BOXES

Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. *See page 92*
Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. *See page 98*
Platt Iron Works, Dayton, O. *See page 290*
Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*
 ***Wood & Co., R. D.**, Philadelphia, Pa. *See pages 294, 295*

VALVE CHAMBERS REBORED

Hartford Engine Works, 223 State St., Hartford, Conn.

VALVE CHESTS, UNIVERSAL (Locomotive)
Economy Devices Corp'n, 30 Church St., New York, N. Y.

VALVE DISCS

Allen & Son, A., 494 Greenwich St., New York, N. Y. *See page 200*

***American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

Goetze Gasket & Packing Co., New Brunswick, N. J.

***Goodrich Co., B. F.**, Akron, O. *See pages 133, 165*

***Jenkins Bros.**, 80 White St., New York, N. Y. *See pages 96, 97*

La Favorite Rubber Mfg. Co., Hawthorne, N. J.

Mechanical Rubber Co., Cleveland, O. *See page 169*

VALVE FINISHING MACHINES (Globe)

Pottstown Machine Co., Pottstown, Pa.

VALVE GEARS (Locomotive)

Pyle-National Co., Chicago, Ill.

VALVE RESEATING MACHINES

Leavitt Machine Co., Orange, Mass.

VALVES**Acid**

Eastwood Wire Mfg. Co., Belleville, N. J.

United Iron Works Co., Iola, Kan.

Whitcomb Co., Geo. D., Rochelle, Ill.

Air (Automatic)

***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*

Harlem Mfg. Co., 518-526 W. 55th St., New York, N. Y.

***Jenkins Bros.**, 80 White St., New York, N. Y. *See pages 96, 97*

Marsh & Co., Jas. P., 118-124 S. Clinton St., Chicago, Ill.

Monash-Younger Co., 1407 W. Jackson Blvd., Chicago, Ill.

National Steam Specialty Co., 12 S. Clinton St., Chicago, Ill.

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

***Smith Co., H. B.**, Westfield, Mass. *See pages 308, 309*

Air Operating

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Air Relief

***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Altitude

Chaplin-Fulton Mfg. Co., 28-34 Penn Ave., Pittsburgh, Pa.

Simplex Valve & Meter Co., 112 N. Broad St., Philadelphia, Pa.

Ammonia

***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

De La Vergne Machine Co., 1123 E. 138th St., New York, N. Y. *See page 25*

Edward Valve & Mfg. Co., 343 S. Dearborn St., Chicago, Ill.

Frick Co., Waynesboro, Pa.

***Jenkins Bros.**, 80 White St., New York, N. Y. *See pages 96, 97*

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

***Vilter Mfg. Co.**, 1194-1196 Clinton St., Milwaukee, Wis. *See page 277*

Vogt Machine Co., Henry, Louisville, Ky. *See page 55*

*Advertisements of firms marked * appear in The Journal, A. S. M. E.*

Automatic Cut-off (Gas)

Oven Equipment & Mfg. Co., New Haven, Conn.

Back Pressure

American District Steam Co., North Tonawanda, N. Y. *See page 118*

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

*Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.

Fisher Governor Co., Marshalltown, Ia.

Foster Engineering Co., Newark, N. J. *See page 109*

Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. *See pages 76, 77*

Illinois Engineering Co., 5021-7 S. State St., Chicago, Ill.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*

Konold Co., J., 602 Bessemer Bldg., Pittsburgh, Pa.

McGowan Co., John H., Cincinnati, O.

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*

Balanced

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

*Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.

Foster Engineering Co., Newark, N. J. *See page 109*

*Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa. *See page 93*

Nason Mfg. Co., 71 Fulton St., New York, N. Y.

Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*

Balanced Distribution

American Balanced Valve Co., Jersey Shore, Pa.
Baker Valve Co., 1855 W. 28th St., Minneapolis, Minn.

Ball

Detroit Ball Valve Co., 572-580 Franklin St., Detroit, Mich.

Farrell Valve & Specialty Co., 110 Franklin St., Buffalo, N. Y.

Blowoff

*Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*

Bashlin Co., Warren, Pa.

Cadman Mfg. Co., A. W., 2814-2816 Smallman St., Pittsburgh, Pa.

Coale Muffler & Safety Valve Co., 325 E. Oliver St., Baltimore, Md.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass. *See page 324*

D. G. C. Trap & Valve Co., Inc., 81 E. 41st St., New York, N. Y.

Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

*Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa. *See page 93*

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Liberty Mfg. Co., 6907 Susquehanna St., Pittsburgh, Pa.

Ohio Injector Co., S. Main St., Wadsworth, O.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Powell Co., Wm., 2521-31 Spring Grove Ave., Cincinnati, O.

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*

Scully Steel & Iron Co., Chicago, Ill.

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Steam Appliance Co., West Allis, Wis.

Vance-Vetter Co., First National Bank Bldg., Pittsburgh, Pa.

*Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Butterfly

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. *See page 306*

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Union Water Meter Co., 41 Hermon St., Worcester, Mass.

Check

American Valve Co., Cossackie, N. Y.

Coffin Valve Co., Neponset, Mass.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

Crosby Steam Gage & Valve Co., 40 Central St., Boston, Mass. *See page 324*

Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. *See page 92*

Detroit Ball Valve Co., 572-580 Franklin St., Detroit, Mich.

Eddy Valve Co., Waterford, N. Y.

Globe Automatic Sprinkler Co., 2035 Washington Ave., Philadelphia, Pa.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

Kelly & Jones Co., Greensburg, Pa. *See pages 94, 95*

Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. *See page 98*

Peer Mfg. Co., Comstock, Mich.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

*Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. *See page 129*

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*

*Wood & Co., R. D., Philadelphia, Pa. *See pages 294, 295*

Worthington Pump & Mch. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

Drifting

Coale Muffler & Safety Valve Co., 325 E. Oliver St., Baltimore, Md.

Dry Pipe (Sprinkler)

Globe Automatic Sprinkler Co., 2035 Washington Ave., Philadelphia, Pa.

Exhaust Relief

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*

*Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.

Foster Engineering Co., Newark, N. J. *See page 109*

Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. *See pages 76, 77*

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*

Wheeler Mfg. Co., C. H., Philadelphia, Pa. *See page 85*

Val

See Catalogue Section for data of firms listed in bold face type

VALVES (continued)

Float

- Atlas Valve Co., Inc., 90 West St., New York, N. Y.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 *Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.
 Foster Engineering Co., Newark, N. J. See page 109
 *Golden-Anderson Valve Specialty Co., 1228 Fulton Bldg., Pittsburgh, Pa.
 *Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa. See page 93
 Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. See page 110
 Lewis Steam Specialty & Valve Co., 2218-24 Vine St., Philadelphia, Pa.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Schade Valve Mfg. Co., 2542 N. American St., Philadelphia, Pa.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Foot

- Coffin Valve Co., Neponset, Mass.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99
 *Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295
 Worthington Pump & Mch'y. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. See pages 26, 86, 276, 291

Gate

- American Steam Gauge & Valve Mfg. Co., Boston, Mass. See pages 115, 322
 American Valve Co., Coxsackie, N. Y.
 Chapman Valve Mfg. Co., Indian Orchard, Mass.
 Coffin Valve Co., Neponset, Mass.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324
 Darling Pump & Mfg. Co., Ltd., Williamsport, Pa. See page 92
 Detroit Brass Works, Detroit, Mich.
 Eddy Valve Co., Waterford, N. Y.
 Fairbanks Co., 416 Broome St., New York, N. Y.
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
 Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. See page 98
 *Ludlow Valve Mfg. Co., Troy, N. Y.
 Marshall Foundry Co., 28th & Railroad Sts., Pittsburgh, Pa. See page 306
 National Valve & Mfg. Co., Pittsburgh, Pa.
 *Nelson Valve Co., Chestnut Hill, Philadelphia, Pa.
 Pittsburgh Valve & Fittings Co., Barberton, O.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 Rensselaer Valve Co., Troy, N. Y.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Smith Mfg. Co., A. P., East Orange, N. J.
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99
 Williams Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.
 *Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Globe, Angle and Cross

- American District Steam Co., North Tonawanda, N. Y. See page 118
 Bashlin Co., Warren, Pa.
 Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324
 Detroit Ball Valve Co., 672-580 Franklin St., Detroit, Mich.
 Farrell Valve & Specialty Co., 110 Franklin St., Buffalo, N. Y.
 Glenn, Clifford C., 1934 Fremont St., Chicago, Ill.
 Jarecki Mfg. Co., Erie, Pa.
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 Kelly & Jones Co., Greensburg, Pa. See pages 94, 95
 Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. See page 98
 McNab & Harlin Mfg. Co., 55 John St., New York, N. Y.
 Milwaukee Valve Co., 139 Burrell St., Milwaukee, Wis.
 Ohio Brass Co., Mansfield, O.
 Ohio Injector Co., S. Main St., Wadsworth, O.
 Penberthy Injector Co., Detroit Mich. See page 117
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Powell Co., Wm., 2521-31 Spring Grove Ave., Cincinnati, O.
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 *Richardson-Phenix Co., 126 Reservoir Ave., Milwaukee, Wis. See page 129
 Sayer Valve Co., St. Louis, Mo.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99

Hose

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. See page 98
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99

Hydraulic

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Edward Valve & Mfg. Co., 343 S. Dearborn St., Chicago, Ill.
 Engberg's Electric & Mechanical Works, St. Joseph, Mich.
 Hydraulic Press Mfg. Co., Mount Gilead, O.
 *Nelson Valve Co., Chestnut Hill, Philadelphia, Pa.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Watson-Stillman Co., 50 Church St., New York, N. Y.
 Williams, Inc., Franklin, 39 Cortlandt St., New York, N. Y.
 Wood Mfg. Co., Wm. H., Media, Pa.
 *Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Hydraulic Operating

- Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Southwark Foundry & Machine Co., Philadelphia, Pa. See page 24
 Vance-Vetter Co., First National Bank Bldg., Pittsburgh, Pa.
 *Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Val

Advertisements of firms marked * appear in The Journal, A. S. M. E.

Locomotive Blower

Sargent Co., Fisher Bldg., Chicago, Ill.

Non-Return

Acton, John, 118 John St., Brooklyn, N. Y.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill.

See pages 88, 89, 90, 91

*Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.

Eynon-Evans Mfg. Co., 15th & Clearfield Sts., Philadelphia, Pa.

Foster Engineering Co., Newark, N. J. *See page 109*

*Golden-Anderson Valve Specialty Co., 1228 Fulton Bldg., Pittsburgh, Pa.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*Kieley & Mueller, Inc., 34 W. 13th St., New York. *See page 110*

Lagonda Mfg. Co., Springfield, O.

*Lukenheimer Co., Cincinnati, O.

*Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

*Schutte & Koerting Co., 12th & Thompson Sts., Philadelphia, Pa.

Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*

Strong, Carlisle & Hammond Co., 326-344 Frankfort Ave., N. W., Cleveland, O.

Piston

American Balance Valve Co., Jersey Shore, Pa.

Baker Valve Co., 1855 E. 28th St., Minneapolis, Minn.

Pyle-National Co., Chicago, Ill.

Plug*Homestead Valve Mfg. Co., P. O. Box 1754, Pittsburgh, Pa. *See page 93**Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103***Pop Safety**American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322**Ashton Valve Co., 271 Franklin St., Boston, Mass. *See page 323*

Coale Muffler & Safety Valve Co., 325 E. Oliver St., Baltimore, Md.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*Detroit Lubricator Co., Detroit, Mich. *See page 125*Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99***Pump***American Vulcanized Fibre Co., Wilmington, Del. *See page 203*

Anchor Packing Co., 608 Lafayette Bldg., Philadelphia, Pa.

Birch Valve & Mfg. Co., 970 Montana St., Chicago, Ill.

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*

Continental Rubber Works, Erie, Pa.

Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324**Goodrich Co., B. F., Akron, O. *See pages 133, 165*

Hill Pump Valve Co., Archer Ave., Chicago, Ill.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97**Johns-Manville Co., H. W., 296 Madison Ave., New York, N. Y. *See page 119*

La Favorite Rubber Mfg. Co., Hawthorne, N. J.

New Jersey Car Spring & Rubber Co., Jersey City, N. J.

Page Belting Co., Concord, N. H.

Pennsylvania Rubber Co., Jeanette, Pa.

*Quaker City Rubber Co., 629 Market St., Philadelphia, Pa.

RadiatorAmerican District Steam Co., North Tonawanda, N. Y. *See page 118*

American Valve Co., Cossackie, N. Y.

*Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*Detroit Lubricator Co., Detroit, Mich. *See page 125*

Dole Valve Co., 208 N. Fifth Ave., Chicago, Ill.

Gorton & Lidgerwood Co., 96 Liberty St., New York, N. Y.

*Jenkins Bros., 80 White St., New York, N. Y. *See pages 96, 97*

Kelly & Jones, Greensburg, Pa.

Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. *See page 98*

Michigan Lubricator Co., 661-701 Beaubien St., Detroit, Mich.

Milwaukee Valve Co., 139 Burrell St., Milwaukee, Wis.

Ohio Brass Co., Mansfield, O.

Ohio Injector Co., S. Main St., Wadsworth, O.

Positive Differential System Co., 132 Nassau St., New York, N. Y.

Pratt & Cady Co., Inc., Hartford, Conn. *See pages 100, 101*

*Sarco Co., Inc., Woolworth Bldg., New York, N. Y.

Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*Stephens Mfg. Co., Roe, Detroit, Mich. *See page 99*

Triumph Valve Mfg. Co., Mansfield, O.

Radiator (Quarter-Turn)

Gorton & Lidgerwood Co., 96 Liberty St., New York, N. Y.

Reducing

American District Steam Co., North Tonawanda, N. Y.

Atlas Valve Co., Inc., 90 West St., New York, N. Y.

Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.

Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.

Chaplin-Fulton Mfg. Co., 28-34 Penn Ave., Pittsburgh, Pa.

*Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.

D'Este Co., Julian, 26 Canal St., Boston, Mass. *See page 108*Dunham Co., C. A., Marshalltown, Ia. *See pages 112, 113*

Fisher Governor Co., Marshalltown, Ia.

Foster Engineering Co., Newark, N. J. *See page 109*

Illinois Engineering Co., 5021-7 S. State St., Chicago, Ill.

Johnson Service Co., Milwaukee, Wis.

Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*Leslie Co., Lyndhurst, N. J. *See page 111*

Lytton Mfg. Corp'n, Franklin, Va.

Mason Regulator Co., Boston, Mass.

Mueller Mfg. Co., H., Decatur, Ill.

National Brake & Electric Co., Milwaukee, Wis. *See pages 278, 279*

Plouff Co., 1500 River St., Boston, Mass.

Ross Valve Mfg. Co., Troy, N. Y.

Schade Valve Mfg. Co., 2542 N. American St., Philadelphia, Pa.

Squires Co., C. E., Cleveland, O.

Waters Governor Co., 1122 Oliver Bldg., Boston, Mass.

Watson & McDaniel Co., 146 N. Seventh St., Philadelphia, Pa.

Western Kieley Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.

Val

See Catalogue Section for data of firms listed in bold face type

VALVES (continued)

Regulating

- Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.
 Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 *Davis Regulator Co., G. M., 422 Milwaukee Ave., Chicago, Ill.
 D'Este Co., Julian, 26 Canal St., Boston, Mass. See page 108
 Foster Engineering Co., Newark, N. J. See page 109
 *Golden-Anderson Valve Specialty Co., 1228 Fulton Bldg., Pittsburgh, Pa.
 Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. See page 110
 Leslie Co., Lyndhurst, N. J. See page 111
 Monash-Younger Co., 1407 W. Jackson Blvd., Chicago, Ill.
 Rochester Vacuum Valve Co., Rochester, N. Y.
 Ross Valve Mfg. Co., Troy, N. Y.
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Western Kieley Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.

Relief (Water)

- American Steam Gauge & Valve Mfg. Co., Boston, Mass.
 *Ashton Valve Co., 271 Franklin St., Boston, Mass. See page 323
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. See page 324
 D'Este Co., Julian, 26 Canal St., Boston, Mass. See page 108
 Foster Engineering Co., Newark, N. J. See page 109
 Lonergan Co., J. E., 211-215 Race St., Philadelphia, Pa. See pages 107, 325
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99
 Triumph Valve Mfg. Co., Mansfield, O.
 *Wood & Co., R. D., Philadelphia, Pa. See pages 294, 295

Reversing (Furnace)

- Knox Pressed & Welded Steel Co., Pittsburgh, Pa.
 Sterrit-Thomas Foundry Co., 32nd & Smallman Sts., Pittsburgh, Pa.

Rubber

- Boston Belting Co., 84 Linden Park St., Boston, Mass.
 Essex Rubber Co., Trenton, N. J.

Safety

- American Steam Gauge & Valve Mfg. Co., Boston, Mass.
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Detroit Lubricator Co., Detroit, Mich. See page 125
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 National Brake & Electric Co., Milwaukee, Wis. See pages 278, 279
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104

Slide

- American Balance Valve Co., Jersey Shore, Pa.
 Stop and Check
 (See Valves, Non-Return)

Superheated Steam (Steel)

- Chapman Valve Mfg. Co., Indian Orchard, Mass.

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Edward Valve & Mfg. Co., 343 S. Dearborn St., Chicago, Ill.
 Foster Engineering Co., Newark, N. J. See page 109
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 McNab & Harlin Mfg. Co., 55 John St., New York, N. Y.
 National Valve & Mfg. Co., Pittsburgh, Pa.
 *Nelson Valve Co., Chestnut Hill, Philadelphia, Pa.
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99
 *Walworth Mfg. Co., Boston, Mass.

Throttle

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 Detroit Lubricator Co., Detroit, Mich. See page 125
 Gardner Governor Co., Quincy, Ill. See page 274
 *Jenkins Bros., 80 White St., New York, N. Y. See pages 96, 97
 Kennedy Valve Mfg. Co., 1100 E. Water St., Elmira, N. Y. See page 98
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. See pages 102, 103
 Pratt & Cady Co., Inc., Hartford, Conn. See pages 100, 101
 Simmons Co., John, 110 Centre St., New York, N. Y. See page 104
 Stephens Mfg. Co., Roe, Detroit, Mich. See page 99

Trap

- Bashlin Co., Warren, Pa.

Vacuum-Heating

- *Crane Co., 836 S. Michigan Ave., Chicago, Ill. See pages 88, 89, 90, 91
 D. G. C. Trap & Valve Co., Inc., 81 E. 41st St., New York, N. Y.
 Open Coil Heater & Purifier Co., Indianapolis, Ind.
 Peerless Engineering Co., 1253-38 S. Dearborn St., Chicago, Ill.
 Rochester Vacuum Valve Co., Rochester, N. Y.
 *Sarco Co., Inc., Woolworth Bldg., New York, N. Y.

VARIABLE SPEED TRANSMISSIONS
 (See Speed Transmissions, Variable)

VEHICLE MACHINERY

- *Defiance Machine Works, Defiance, O.
VENEER CUTTING MACHINERY (Rotary)
 White-Blakeslee Mfg. Co., Birmingham, Ala.

VENTILATING SYSTEMS

- American Blower Co., Detroit, Mich. See pages 280, 281

VENTILATORS, ROOF

- Bicalky Fan Co., 866 Prospect Ave., Buffalo, N. Y.
 Burt Mfg. Co., Akron, O.
 New England Ventilating & Heating Co., 926 Manton Ave., Providence, R. I.
 Nightingale & Childs Co., 205 Congress St., Boston, Mass.
 Ohio Blower Co., Cleveland O.
 Pullman Ventilator Corp'n, York, Pa.
 Van Noorden & Co., E., 100 Magazine St., Boston, Mass.
 Willcox Engineering Co., Saginaw, Mich. See page 317

VISCOSIMETERS

- Tagliabue Mfg. Co., C. J., 18-88 33rd St., Brooklyn, N. Y. See page 330

Val

VICES

Carter & Hakes Machine Co., Winsted, Conn.
Emmert Mfg. Co., Waynesboro, Pa.
Hogson & Pettis Mfg. Co., New Haven, Conn.
See pages 250, 251, 252
Kempsmith Mfg. Co., Station A, Milwaukee, Wis.
Merrill Bros., Maspeth, (Queens Borough) New York, N. Y.
Newhall Chain Forge & Iron Co., 90 West St., New York, N. Y. *See page 173*
Prentiss Vise Co., 110 Lafayette St., New York, N. Y.
Reed Mfg. Co., Erie, Pa.
Drill Press
Armstrong-Blum Mfg. Co., 339 N. Francisco Ave., Chicago, Ill.
Graham Mfg. Co., Providence, R. I.
Skinner Chuck Co., New Britain, Conn.

Machine Tool

Queen City Machine Tool Co., 1405 Sycamore St., Cincinnati, O.

Pattern Makers'

Upton & Gilman Machine Co., 587 Middlesex St., Lowell, Mass.

Pipe

***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill.
See pages 88, 89, 90, 91
Prentiss Vise Co., 110 Lafayette St., New York, N. Y.
Sanders Sons, Inc., D., 21 Atherton St., Yonkers, N. Y.
Spencer Regulator Co., Salem, Mass.
Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, O.

Wood Working

Emmert Mfg. Co., Waynesboro, Pa.
Prentiss Vise Co., 110 Lafayette St., New York, N. Y.

VOLTMETERS

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*
 ***Bristol Co.**, Waterbury, Conn. *See page 327*
Brown Instrument Co., Philadelphia, Pa. *See page 328*
 ***General Electric Co.**, Schenectady, N. Y. *See pages 30, 31*
Pignolet, Louis M., 78 Cortlandt St., New York, N. Y.
 ***Weston Electrical Instrument Co.**, Waverly Park, Newark, N. J. *See page 333*
Wilson-Maeulen Co., 781 E. 142nd St., New York, N. Y.

VULCANIZERS

***Bigelow Co.**, 76 River St., New Haven, Conn. *See page 40*
Williams Foundry & Machine Co., Akron, O.

W**WASHERS****Felt**

Booth Felt Co., Inc., 440-450 14th St., Brooklyn, N. Y.

Lead

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

Leather

Detroit Leather Specialty Co., Inc., 15 Beecher St., Detroit, Mich.
Graton & Knight Mfg. Co., Worcester, Mass. *See page 166*
 ***Schieren Co.**, Chas. A., 30-38 Ferry St., New York, N. Y. *See page 170*

Lock

National Lock Washer Co., Newark, N. J.

Rubber

Boston Belting Co., 84 Linden Park St., Boston, Mass. *See page 162*
 ***Goodrich Co.**, B. F., Akron, O. *See pages 133, 165*
 ***Jenkins Bros.**, 80 White St., New York, N. Y. *See pages 96, 97*
Mechanical Rubber Co., Cleveland, O. *See page 169*

Thrust

Michigan Screw Co., Lansing, Mich.

Vulcanized Fibre

***American Vulcanized Fibre Co.**, Wilmington, Del. *See page 203*

Wrought

Auburn Ball Bearing Co., 22 Elizabeth St., Rochester, N. Y. *See page 154*
Bayonne Bol. & Nut Co., Bayonne, N. J.
Falls River Co., Kent, O.
Milton Mfg. Co., Milton, Pa. *See page 258*
WASHING AND SCREENING MACHINERY
 (Gravel and Rock)

Meese & Gottfried Co., San Francisco, Cal.

WASTE WASHING CENTRIFUGALS

(See Centrifugals, Oil and Waste)

WATCHMEN'S RECORDERS

Newman Clock Co., 178 Fulton St., New York, N. Y. *See page 336*
Simplex Time Recorder Co., Gardner, Mass.

WATER BACKS (Pressure)

Green Engineering Co., East Chicago, Ill. *See pages 64, 65*

WATER CIRCULATORS, FILTERS, GAGES, HEATERS, METERS, SPRAYS, ETC.

(See Circulators, Filters, Gages, Heaters, Meters, Sprays, etc., Water)

WATER COLUMNS

American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 ***Ashton Valve Co.**, 271 Franklin St., Boston, Mass. *See page 323*
 ***Crane Co.**, 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*
Engineering Co. of Philadelphia, 509 Harrison Bldg., Philadelphia, Pa.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*

Alarm

Binghamton Machine Works, 38 Chenango St., Binghamton, N. Y.
Engineering Co. of Philadelphia, Pa., 509 Harrison Bldg., Philadelphia, Pa.
Hills-McCanna Co., 153 W. Kinzie St., Chicago, Ill.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y. *See page 110*
Steigert Co., L., Elder & Logan Sts., Cincinnati, O.
Williams Gauge Co., 543 Fourth Ave., Pittsburgh, Pa.

Railroad

Stickney Co., Chas. A., St. Paul, Minn.

WATER COOLING APPLIANCES

Cooling Tower Co., 50 Broad St., New York, N. Y.

***Spray Engineering Co.**, 93 Federal St., Boston, Mass. *See page 87*
Zellweger & Sons, John, 1900 Adelaide Ave., St. Louis, Mo.

WATER PROOFING MATERIALS

***Johns-Manville Co.**, H. W., 296 Madison Ave., New York, N. Y. *See page 119*
 ***Texas Co.**, 17 Battery Pl., New York, N. Y. *See page 124*
United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

See Catalogue Section for data of firms listed in bold face type

WATER PURIFYING PLANTS

Electric Water Sterilizer Co., Scottdale, Pa.
 Hodges Water Still Co., Pennsylvania Bldg., Philadelphia, Pa.
 Loomis-Manning Filter Mfg. Co., 1421-1455 S. 37th St., Philadelphia, Pa.
 Roberts Filter Mfg. Co., Darby, Pa.
 *Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

WATER SOFTENERS

American Water Softener Co., 1011 Chestnut St., Philadelphia, Pa.
 Booth Co., L. M., 62 Hudson St., Jersey City, N. J.
 Cartwright-Caps Co., 1240 Transportation Bldg., Chicago, Ill.
 Cookson Steam Specialty Co., 60-62 Central Ave., Cincinnati, O.
 Dodge Sales & Engineering Co., Mishawaka Ind. *See pages 74, 144, 145, 146, 147*
 *Graver Tank Works, Wm., East Chicago, Ind.
 Harrison Safety Boiler Works, 3130 N. 17th St., Philadelphia, Pa. *See pages 76, 77*
 International Filter Co., Chicago, Ill.
 Northern Water Softener Co., Madison, Wis.
 Norwood Engineering Co., Florence, Mass.
 Power Plant Specialty Co., 1306 Monadnock Bldg., Chicago, Ill.
 Reiser Automatic Water Purifying Co., 30 Church St., New York, N. Y.
 *Scaife & Sons Co., Wm. B., 221 First Ave., Pittsburgh, Pa. *See page 75*

WATER SUPPLY SYSTEMS

Deming Co., Salem, O. *See page 285*
 Mast Foss & Co., Springfield, O.
 Rider Ericsson Engine Co., 20 Murray St., New York, N. Y.
 Standard Pump & Engine Co., Akron, O.
 United Pump & Power Co., Ft. of Bellevue Place, Milwaukee, Wis.

WATER TUBE BOILERS
(See Boilers, Water Tube)**WATER WHEELS**

Davis Foundry & Machine Works, Rome, Ga.
 *Holyoke Machine Co., Holyoke, Mass.
 Hunt Machine Co., Rodney, Orange, Mass.
 Jolly, Inc., J. & W., Holyoke, Mass.
 Leffel & Co., James, 501 Lagonda St., Springfield, O.
 *Morris Co., I. P., Philadelphia, Pa. *See page 296*
 Munson Mill Machinery Co., Inc., 405 Broadway, Utica, N. Y.
 Platt Iron Works, Dayton, O. *See page 290*
 Poole Engineering & Machine Co., Baltimore, Md.
 Smith Co., S. Morgan, York, Pa.
 Trump Mfg. Co., Springfield, O.

WATERWORKS SUPPLIES

Bayard & Co., M. L., Woodbine, N. J.
 Smith Mfg. Co., A. P., East Orange, N. J.
 Walker Mfg. Co., Fenton, Mich.

WATTMETERS

Biddle, James G., 1211-13 Arch St., Philadelphia, Pa. *See page 338*
 *Bristol Co., Waterbury, Conn. *See page 327*
 Brown Instrument Co., Philadelphia, Pa. *See page 328*
 *General Electric Co., Schenectady, N. Y. *See pages 30, 31*
 *Weston Electrical Instrument Co., Waverly Park, Newark, N. J. *See page 333*

WATT-HOUR METERS

(See Meters, Watt-Hour)

WEBBING

Gilmer Co., L. H., Vincent St., Tacony, Phila., Pa. *See page 164*

WEIGHING MACHINERY (Automatic)

Automatic Weighing Machine Co., 134-140 Commerce St., Newark, N. J.
 Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*

Electric Weighing Co., 180 13th Ave., New York, N. Y.
 Fairbanks Co., 416 Broome St., New York, N. Y.
 Richardson Scale Co., Passaic, N. J.
 Streeter Amet Weighing & Recording Co., 4101-5 Ravenwood Ave., Chicago, Ill.
 Willcox Engineering Co., Saginaw, Mich. *See page 317*

WEIGHERS**Conveying**

Conveying Weigher Co., 90 West St., New York, N. Y. *See page 175*

Water

Richardson Scale Co., Passaic, N. J.
 Willcox Engineering Co., Saginaw, Mich. *See page 317*
 Worthington Pump & Mch'y. Corp'n (Henry R. Worthington), 115 Broadway, New York, N. Y. *See pages 26, 86, 276, 291*

WELDING**Electric**

Metals Welding Co., 4400 Perkins Ave., Cleveland, O.
 Steel Products Co., Cleveland, O.
 Thomas Electric Welding Co., Lynn, Mass. *See page 242*
 Toledo Electric Welder Co., Cincinnati, O.
 Universal Electric Welding Co., 67-79 Sixth St., Long Island City, N. Y.

Chemical Reaction

Goldschmidt Thermit Co., 120 Broadway, New York, N. Y.

Lap

American Welding Co., Carbondale, Pa.

Rail

Goldschmidt Thermit Co., 120 Broadway, New York, N. Y.

Spot

Universal Electric Welding Co., 67-79 Sixth St., Long Island City, N. Y.

WELDING AND CUTTING (Flame)

Cave Welding & Mfg. Co., 32 Liberty St., Springfield, Mass.
 Glasgow Iron Co., Pottstown, Pa. *See page 60*
 Henderson-Willis Welding & Cutting Co., 2305-7-9 N. 11th St., St. Louis, Mo.
 Linde Air Products Co., 42nd St. Bldg., New York, N. Y.
 Metals Welding Co., 4400 Perkins Ave., Cleveland, O.
 Oxweld Acetylene Co., 36th St. & Jasper Pl., Chicago, Ill.
 Phoenix Iron Works Co., Meadville, Pa. *See page 53*
 *Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. *See pages 102, 103*
 Prest-O-Lite Co., Inc., Indianapolis, Ind.
 Steel Products Co., Cleveland, O.
 Thermalene Co., 17th St. & Lowe Ave., Chicago Heights, Ill.

WELDING AND CUTTING APPARATUS (Flame)

Carbic Mfg. Co., West Duluth, Minn.
 David-Bournonville Co., Marion Station, Jersey City, N. J.
 Dyer Co., G. H., Cambridge, Mass.
 Economy Welding Machine Co., S. W. Blvd. & Central St., Kansas City, Mo.
 General Welding & Equipment Co., 107 Massachusetts Ave., Boston, Mass.
 Henderson-Willis Welding & Cutting Co., 2305-7-9 N. 11th St., St. Louis, Mo.
 Imperial Brass Mfg. Co., 1200 West Harrison St., Chicago, Ill.
 Macleod Co., Cincinnati, O.
 Messer & Co., 121 N. Seventh St., Philadelphia, Pa.
 Metals Welding Co., 4400 Perkins Ave., Cleveland, O.

Wat

Milburn Co., Alexander, 1420-1426 W. Baltimore St., Baltimore, Md.
 Modern Engineering Co., 14th & St. Charles Sts., St. Louis, Mo.
 Oxweld Acetylene Co., 36th St. & Jasper Pl., Chicago, Ill.
 Oxy-Carbi Co., New Haven, Conn.
 Thermalene Co., 17th St. & Lowe Ave., Chicago Heights, Ill.
 Waterhouse Welding Co., Boston, Mass.

WELDING MACHINES, ELECTRIC
 C. & C. Electric & Mfg. Co., Garwood, N. J.
 Eveland Engineering & Mfg. Co., Drexel Bldg., Philadelphia, Pa.
 National Electric Welder Co., Warren, O.
 Thomas Electric Welding Co., Lynn, Mass. *See page 242*
 Toledo Electric Welder Co., Cincinnati, O.
 Universal Electric Welding Co., 67-79 Sixth St., Long Island City, N. Y.

Resistance Method
 Thomson Electric Welding Co., Lynn, Mass. *See page 242*

WELDING SUPPLIES
 Economy Welding Machine Co., S. W. Blvd. & Central St., Kansas City, Mo.
 General Welding & Equipment Co., 107 Massachusetts Ave., Boston, Mass.
 Modern Engineering Co., 14th & St. Charles Sts., St. Louis, Mo.

WELL-DRILLING MACHINERY
 American Well Works, Aurora, Ill.
 Armstrong Mfg. Co., Waterloo, Ia.
 Oil Well Supply Co., 213-215 Water St., Pittsburgh, Pa.

WELL SUPPLIES
 McDonald Mfg. Co., A. Y., Dubuque, Ia.

WHEATSTONE BRIDGES
 Thompson-Levering Co., 323 Arch St., Philadelphia, Pa.

WHEELBARROWS
 Stuebner Iron Works, G. L., Hancock St. & Vernon Ave., Long Island City, N. Y. *See page 196*

WHEELS

Car
 American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa. *See page 142*
 American Steel Foundries, 1163 McCormick Bldg., Chicago, Ill.
 Bass Foundry & Machine Co., Fort Wayne, Ind. *See page 39*
 Engine & Machinery Co., Canton, O.
 Lehigh Car, Wheel & Axle Works, Catsaqua, Pa. *See page 69*
 *Link-Belt Co., Chicago, Ill. *See page 178*
 Lobdell Car Wheel Co., Wilmington, Del.
 Midvale Steel Co., Widener Bldg., Philadelphia, Pa.
 Pressed Steel Car Co., Farmers Bank Bldg., Pittsburgh, Pa.

Iron and Rubber
 Clark Co., George P., Windsor Locks, Conn.

Mine Car
 Hockensmith Wheel & Mine Car Co., Penns Station, Pa.
 Watt Mining Car Wheel Co., Barnesville, O.

Roller Bearing
 Day Iron Works, Sanford, Knoxville, Tenn.
 Hockensmith Wheel & Mine Car Co., Penns Station, Pa.

Steel (Motor Truck)
 Celfor Tool Co., Buchanan, Mich.

Trolley
 Lumen Bearing Co., Buffalo, N. Y. *See page 201*

WHISTLE CONTROL. (Steamship)
 McNab Co., Bridgeport, Conn.

WHISTLES, STEAM

American Steam Gauge & Valve Mfg. Co., Boston, Mass. *See pages 115, 322*
 *Ashtoa Valve Co., 271 Franklin St., Boston, Mass. *See page 323*
 *Brown Co., A. & F., 79 Barclay St., New York, N. Y. *See page 136*
 *Crane Co., 836 S. Michigan Ave., Chicago, Ill. *See pages 88, 89, 90, 91*
 Crosby Steam Gauge & Valve Co., 40 Central St., Boston, Mass. *See page 324*
 Longergan Co., J. E., 211-215 Race St., Philadelphia, Pa. *See pages 107, 325*
 Simmons Co., John, 110 Centre St., New York, N. Y. *See page 104*

WHITE LEAD

National Lead Co., 111 Broadway, New York, N. Y. *See pages 260, 261*

WHITE METALS

(See Metals, White)

WINCHES, SHIPS'

*Lidgerwood Mfg. Co., 96 Liberty St., New York, N. Y. *See page 191*
 Round & Son, D., Cleveland, O.

WIRE**All Metals (In Fine Gauges)**

Michigan Wire Cloth Co., 536 Howard St., Detroit, Mich.

Aluminum

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

Annealed

Pittsburgh Steel Co., Frick Bldg., Pittsburgh, Pa.

Brass and Copper

American Brass Co., Waterbury, Conn. *See page 204*

Hazard Mfg. Co., Wilkes-Barre, Pa.

*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*

Flat

*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*

Spencer Wire Co., Worcester, Mass.

Iron and Steel

*Roebbling's Sons Co., John A., Trenton, N. J. *See page 172*

Spencer Wire Co., Worcester, Mass.

Ward's Sons, Edgar T., 50 Farnsworth St., Boston, Mass. *See page 209*

Youngstown Sheet & Tube Co., Youngstown, O.

Magnet

Acme Wire Co., New Haven, Conn.

Nickel

Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*

Piano

Montgomery & Co., Inc., 105-107 Fulton St., New York, N. Y.

Resistance

Haring, Ellsworth, 114-118 Liberty St., New York, N. Y. *See page 207*

Tool Steel

Pittsburgh Tool Steel Wire Co., Monaca, Pa.

Welding

Central Steel & Wire Co., 119 N. Peoria St., Chicago, Ill.

Swedish Iron & Steel Corp'n, 12 Platt St., New York, N. Y.

WIRE AND CABLES, ELECTRICAL

Aluminum Co. of America, Pittsburgh, Pa. *See page 205*

American Brass Co., Waterbury, Conn. *See page 204*

American Steel & Wire Co., 72 W. Adams St., Chicago, Ill.

See Catalogue Section for data of firms listed in bold face type

WIRE AND CABLES, ELECTRICAL (continued)

D & W Fuse Co., Providence, R. I. *See page 253*

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

Hazard Mfg. Co., Wilkes-Barre, Pa.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind.

*Roebbing's Sons Co., John A., Trenton, N. J. *See page 172*

Simplex Wire & Cable Co., 201 Devonshire St., Boston, Mass.
Western Electric Co., Inc., 195 Broadway, New York, N. Y.

WIRE CARDS

Rogers Wire Works, Inc., 291 Broadway, New York, N. Y.

WIRE CLOTH

Buffalo Wire Works Co., 480 Terrace, Buffalo, N. Y.

*Caldwell & Son Co., H. W., 17th St. & Western Ave., Chicago, Ill. *See page 174*

Darby & Sons Co., Inc., Edward, 233-235 Arch St., Philadelphia, Pa.

Howard & Morse, 45 Fulton St., New York, N. Y.

Michigan Wire Cloth Co., 536 Howard St., Detroit, Mich.

New Jersey Wire Cloth Co., Trenton, N. J.

Rogers Wire Works, Inc., 291 Broadway, New York, N. Y.

Weller Mfg. Co., 1820-1856 N. Kostner Ave., Chicago, Ill. *See pages 180, 181, 182*

Wright Wire Co., 69 Hammond St., Worcester, Mass.

WIRE DRAWING MACHINERY

Aetna Foundry & Machine Co., Warren, O.

Standard Machinery Co., Auburn, R. I.

Torrington Mfg. Co., Torrington, Conn. *See page 240*

WIRE FORMING MACHINES

Baird Machine Co., Bridgeport, Conn.

Manville Machine Co., E. J., Waterbury, Conn.

Smurr & Kamen Co., 313 N. Wheppie St., Chicago, Ill.

WIRE INSULATING MACHINERY

(*See Insulating Machinery for Wire*)

WIRE MILL MACHINERY

Morgan Construction Co., Worcester, Mass.

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE NAIL MACHINERY

Perkins Co., Henry, Bridgewater, Mass.

WIRE ROPE

(*See Rope, Wire*)

WIRE ROPE FASTENINGS

American Hoist & Derrick Co., St. Paul, Minn.

Broderick & Bascom Rope Co., St. Louis, Mo.

*Roebbing's Sons Co., John A., Trenton, N. J. *See page 172*

WIRE ROPE MACHINES

New England Butt Co., Providence, R. I. *See page 304*

WIRE SCREENS

Michigan Wire Cloth Co., 536 Howard St., Detroit, Mich.

New Jersey Wire Cloth Co., Trenton, N. J.

WIRE SPECIALTIES

Campbell Wire Specialty Works, South Bend, Ind.

Spencer Wire Co., Worcester, Mass.

WIRE STRAIGHTENING MACHINES

Nilson Machine Co., A. H., 1525 Railroad Ave., Bridgeport, Conn.

WIRE TESTING MACHINES

Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. *See page 312*

Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. *See page 313*

WIRING DEVICES

*General Electric Co., Schenectady, N. Y. *See pages 30, 31*

WOOD PRODUCTS (Balsa)

Wood Encysting Corp'n, 30 E. 42nd St., New York, N. Y.

WOOD SEASONING

Wood Encysting Corp'n, 30 E. 42nd St., New York, N. Y.

WOOD SCREW MACHINERY

Cook Co., Asa S., Hartford, Conn.

Townsend Mfg. Co., H. P., Hartford, Conn.

WOOD SPLITTING MACHINES

Carthage Machine Co., Carthage, N. Y.

Clark Foundry Co., Rumford, Me.

WOOD WORKING MACHINERY

Bridgeport Engineering Co., Bridgeport, Conn.

*Defiance Machine Works, Defiance, O.

Enterprise Co., Columbiana, O.

Fay & Scott, Dexter, Me.

New Britain Machine Co., New Britain, Conn.

Oliver Machinery Co., Grand Rapids, Mich.

Olney & Warren, 406-412 Broome St., New York, N. Y.

Pettingell Machine Co., Amesbury, Mass.

Prybille Machine Co., P., 512-524 W. 41st St., New York, N. Y.

Sinker Davis Co., Indianapolis, Ind.

WOOL, LEAD

United Lead Co., 111 Broadway, New York, N. Y. *See page 202*

WORM DRIVES

Hindley Gear Co., 1105 Frankford Ave., Philadelphia, Pa.

Timken-David Brown Co., 136-210 Clark Ave., Detroit, Mich.

WORSTED MACHINERY

Saco-Lowell Shops, 77 Franklin St., Boston, Mass.

WRENCHES

Barcalo Mfg. Co., Buffalo, N. Y.

Billings & Spencer, Hartford, Conn.

Cutter, Geo. A., Taunton, Mass.

*Greene, Tweed & Co., 109 Duane St., New York, N. Y. *See page 126*

Mossberg Co., Frank, Attleboro, Mass.

Page-Storms Drop Forge Co., Chicopee Falls, Mass.

*Roebbing's Sons Co., John A., Trenton, N. J. *See page 172*

Whitman & Barnes Mfg. Co., Akron, O.

Tap

Card Mfg. Co., S. W., Mansfield, Mass.

Wir

